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LECTURES ON SURGERY.

THE UNIVERSITY OF ST. LOUIS

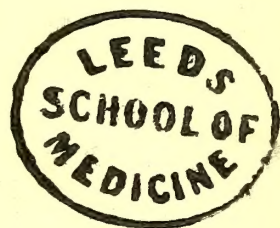


LECTURES ON SURGERY

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EDINBURGH, ETC. ETC.

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EXPLANATION OF PLATES.

LIGATURE OF ARTERIES.—PLATE XXVII.—Page 649.

- Fig. 1. Outline figure, showing the lines of incision for exposing the arteries of the arm and forearm.
- Fig. 2. Lines of incision for exposing the common carotid, third portion of the subclavian, and upper third of the axillary artery.
- Fig. 3. Incision for exposing the femoral artery at the apex of Scarpa's triangle.
- Fig. 4. Form of aneurism-needle recommended.

PLATE XXVIII.—Page 660.

- Fig. 1. Sketch from nature, showing the parts as seen after performing ligature of the right common carotid artery above the omohyoid muscle.
- Fig. 2. Sketch after ligature of the left common carotid below the omohyoid muscle.
- Fig. 3. Dissected view of the parts concerned in ligature of the carotid, showing the relative anatomy of the artery, vagus nerve and internal jugular vein, when the sheath is removed in front. The small nerve, the *descendens noni*, is also seen in front, or superficial to the sheath.
- Fig. 4 shows the incision for exposing the third portion of the subclavian artery. The outer margin of the sterno-mastoid is divided more largely than usual, to exhibit the relative anatomy of *scalenus anticus* muscle to the artery. The position of the external jugular vein; posterior belly of the omohyoid muscle, *transversalis colli* artery and the brachial plexus of nerves are also seen, the cellular tissue having been dissected away to expose these parts.

PLATE XXIX.—Page 686.

- Fig. 1. Incision for ligature of the external iliac artery (after Manec). The peritoneal sac is separated from the iliac fossa, and held

aside, so as to expose the external iliac artery and vein, and some of the ilio-lumbar nerves.

Fig. 2. Sketch from Nature, representing ligature of the femoral artery at the apex of Scarpa's triangle. The edge of the sartorius muscle is seen held aside, exposing the sheath of the vessels, which has been opened over the artery. The edge of the opening in the sheath is shown, held aside by artery-forceps, as described in the Lecture.

Fig. 3 is a dissected view of the same parts, to exhibit the relations of the artery and vein and saphenus nerve to each other at the point of ligature.

Fig. 4 shows the appearance of the wound required for ligature of posterior tibial or the peroneal by the method recommended in the Lecture. The heads of the gastrocnemius are separated, together with the cut edges of the soleus, are held apart and expose the posterior tibial nerve in the centre; and on either side of the nerve the posterior tibial and fibular arteries are seen.

PLATE XXX.—To face Page 691.

Fig. 1. Ligature of the superior part of radial artery. The supinator longus muscle is slightly drawn aside, and along its inner side the radial nerve is exposed, and internally to the nerve the radial artery and its "venæ comites" are seen, the ligature is placed under the artery.

Fig. 2. Ligature of the lower part of radial. The fascia of the forearm has been divided, and the vessels and its accompanying veins are exposed close to the outer side of the flexor carpi radialis muscle.

Fig. 3. Ligature of the upper part of the ulnar artery. The intermuscular fascia between the flexor sublimis digitorum and the flexor carpi ulnaris has been divided, and these muscles drawn aside, exposing the ulnar artery and its satellite veins deeply seated in the wound. A part of the ulnar nerve is seen towards the inner side of the incision partially overlapped by the flexor carpi ulnaris.

Fig. 4. Ligature of the ulnar artery near the wrist. The tendon of the flexor carpi ulnaris, which forms the guide to the vessel at this point, has been slightly drawn inwards to show the relations of ulnar artery and nerve.

Fig. 5. Ligature of the anterior tibial artery in the upper part of the leg. The tibialis anticus muscle is drawn inwards by a hook, to expose the artery and the accompanying veins and nerve.

EXCISION OF JOINTS.—PLATE XXXI.—Page 722.

Fig. 1. Excision of the head of the humerus, by the method recommended in the Lecture, pp. 719-20. The saw is shown in the plate as

applied from behind, as it should be in operating on the left arm. In operating on the right arm, the surgeon grasps the projected head of the bone with his left hand, and saws the bone from before backwards.

- Fig. 2. Outline figure, showing the lines of incision used for excision of the elbow-joint. Page 722. The dotted lines represent the positions of the single, longitudinal, and H incisions.
- Fig. 3. Excision of the elbow by the single longitudinal incision. The position of the narrow saw is shown as applied for removal of articular ends of the ulna and radius.
- Fig. 4. Excision of wrist-joint, by the two lateral incisions, (reduced from a plate in Bourguery and Jacob's *Operative Surgery*). The only difference between this and the modern operation is, that in the latter the bone-pliers and narrow saw are used instead of the chain-saw represented in the plate. See page 725.
- Fig. 5. Excision of the knee-joint by lunated incision. The condyles of the femur have been removed, and the narrow saw is shown as applied for removing a thin slice from the articular surface of the tibia. Pages 731-32.
- Figs. 6, 7, 8, and 9. Dr. Watson's apparatus for the purposes of after-treatment in cases of excision of the knee-joint. Pages 733-34.

PLATE XXXII.—Page 730.

- Fig. 1. Sketch from a photograph of a patient, showing the result of excision of the knee-joint.
- Fig. 2. Sketch from a photograph of a patient after excision of the shoulder-joint by single incision. Showing the appearance of the shoulder, and the power which the arm retains.

AMPUTATION—DISSECTIONS OF STUMPS.—

PLATE XXXIII.—Page 740.

- Fig. 1. Dissection of a double-flap stump of the forearm, showing the muscularity retained, and the neuromata resulting from section of the great nerves. It will be observed that the ends of the median and ulnar nerves, although far from the cicatrix, and deeply covered, present neuromatous enlargement, yet the stump was not a painful one.
- Fig. 2. Dissection of an old stump of the thigh, formed by circular amputation. The femur projects the cicatrix, there are numerous neuromata, one nerve is stretched over the end of the bone.
- Fig. 3. Stump of the thigh formed by anterior and posterior flaps, by Liston's method. The end of the bone, though not projecting, corresponds to the cicatrix. The sartorius and other muscles are

seen to retain their bulk and muscular character. The amputation had been performed in early life, and the head, neck, and trochanters of the femur, are seen to be remarkably altered in form and relation.

- Fig. 4. Stump of leg, formed by long posterior flap method, thirteen years before the patient's death. The fibres of the gastrocnemius and soleus muscles, folded over the end of the bone, present all their muscular character, and very considerable thickness. See page 740.
- Fig. 5. Drawn from a sketch taken by the late Sir Charles Bell, from an operation in the Royal Infirmary. To show the redundancy of muscle in the flap method by transfixion. The case was one of primary amputation.

AMPUTATION.—PLATE XXXIV.—Page 750.

- Figs. 1, 2, 3, 4, and 5, represent the method of amputation of the thigh by a long anterior flap, on the principles recommended by the author. Pages 749-50.
- Fig. 1. The dotted lines mark the incisions and extent of the long anterior and short posterior flap.
- Fig. 2 shows the cut surface of the flaps, and the section of the condyloid end of the femur, after the operation is completed.
- Figs. 3 and 4 are reduced copies of sketches from nature of a stump formed by the above procedure, twenty-one days after the operation. Fig. 3 gives a lateral, and Fig. 4 a front view of the stump. Sketched by Dr. Caton.
- Fig. 5 represents the result of the operation, about a year after the operation. The anterior flap is firmly consolidated over the end of the bone, and the cicatrix is seen to be retracted on the posterior aspect of the limb. By Mr. Livesay.
- Fig. 6 is an outline sketch from a stump, formed by double flap after Liston's method, of equal anterior and posterior flaps. The line of the cicatrix is seen in the centre of the surface of the stump, corresponding to the end of the bone.
- Fig. 7. Outline sketch of the author's modification of Liston's method, described at page 744.

PLATE XXXV.—Page 784.

- Fig. 1. Amputation of a finger, by the method described at page 785.
- Fig. 2. Amputation of forefinger. The distal end of the metacarpal bone is being removed obliquely by the angular cutting-pliers.
- Fig. 3. Removal of middle finger and a portion of the metacarpal bone. The sketch shows the method of applying the straight cutting-pliers for section of the metacarpal bone.

Figs. 4, 5, and 6, represent amputation of the thumb and its metacarpal bone, by the method described at page 788. Fig. 4. The dotted lines mark the incisions, and the thumb as pushed inwards, to relax the muscles and facilitate transfixion. Fig. 5. The thumb stretched, to render the parts tense as the knife cuts out to the surface. Fig. 6. The wound resulting from the operation.

Fig. 7. Partial amputation of the hand, all the fingers removed, leaving the thumb. The flap in this case formed from the palmar aspect of the hand.

Fig. 8. Amputation of the wrist, as described at page 790.

PLATE XXXVI.—Page 794.

Fig. 1. Amputation of the forearm by a long posterior and shorter anterior flap.

Figs. 2 and 3 represent the performance of amputation at the elbow-joint, and the cut surface after disarticulation has been accomplished.

Figs. 4 and 5 show the lines of incision and the flaps as formed in amputation of the upper arm by Mr. Teale's method of rectangular flaps. (From Teale.)

Figs. 6 and 7 represent amputation of the arm by the circular method. In Fig. 7 the edge of the knife is directed obliquely upwards in clearing the bone as recommended by Alanson.

Fig. 8. Amputation of the arm by anterior posterior flaps cut by transfixion.

PLATE XXXVII.—Page 796.

Amputations at the shoulder-joint by the deltoid and double lateral flap methods.

Figs. 1 and 2. Amputation at shoulder by deltoid flap. Fig. 1 represents the formation of the deltoid flap, and exposure of head of the humerus. Fig. 2. Disarticulation. The assistant grasping the vessels previous to cutting the axillary flap. (After Sir Charles Bell.)

Figs. 3 and 4. Method of amputation by two lateral flaps. Fig. 3 represents the method of transfixion in case of the left arm, and the form and extent of the flap. Fig. 4. The posterior lateral flap formed and reflected. The head of the bone has been disarticulated. The knife is about to cut the axillary flap.

PLATE XXXVIII.—Page 800.

Fig. 1. Sketch from a dissection made to exhibit the surgical anatomy of the parts in reference to excision and amputation at the shoulder-joint, as recommended in the Lectures. See pages 719 and 720. Figs. 2 and 3. Amputation at the shoulder-joint by single flap, by the Author's method.

Fig. 2 shows the cut surface after disarticulation. The flap is thrown back, exposing the glenoid cavity and the axilla. The posterior circumflex artery has been dissected on the surface of the flap, to show that its trunk is intact, and only its extreme twigs divided.

Fig. 3 shows the flap brought into position.

Fig. 4 sketched from a patient about a year after the operation had been performed ; and

Fig. 5 is from a patient in whom amputation by the double lateral flap method had been performed. The results of the two methods are contrasted.

AMPUTATIONS.—LOWER EXTREMITY.—PLATE XXXIX.—Page 806.

Figs 1 and 2 show the lines of incision in amputation of the toes, and in partial amputations of the foot.

Fig. 3. Amputation of the phalanges of the great toe. The internal incision is prolonged far down, so as to obtain sufficient covering for the large head of the metatarsal bone.

Fig. 4. Method of amputating the toe by V-shaped incision.

Fig. 5. Amputation of all the toes at their junction with the metatarsus.

Figs. 6 and 7 represent the formation of the plantar flap in Hey's or Lisfranc's amputation, by transfixion or by cutting the flap after disarticulating.

Fig. 8 shows the cut surface resulting from the operation.

Figs. 9, 10, and 11, represent amputation at the ankle by Syme's method. 9 shows the dissection of the heel-flap from the os calcis ; 10, the cut-surface of the stump after completion of the operation ; 11 gives the result of such amputation some years after the operation. Page 811.

Figs. 12 and 13 show the lines of incision in Mackenzie's amputation by internal calcaneal flap. Page 812.

PLATE XL.—Page 814.

Figs. 14 and 15 represent amputation of the leg by a long posterior flap, by the method described at page 814 ; and Fig. 16 represents the result of the operation, from sketches taken from nature.

Figs. 17 and 18 are outline sketches of stumps formed by the above method.

Figs. 19 and 20. Amputation of the thigh by double flap. The lower dotted line in Fig. 19 indicates the long posterior flap as recommended by Liston ; the upper is the extent of the posterior flap as recommended in the author's modification of the double-flap operation. Page 744.

Figs. 21 and 22 exhibit the steps of transfixion and disarticulation in amputation at the hip-joint as described at page 820.

PLATE XLI.—Page 824.—The patient Robert Davidson. After primary amputation at the hip-joint for injury.—See Clinical Cases.

PLATE XLII.—Page 838.—The patient M. W. Showing result of amputation at the hip by double flaps (as recommended at p. 820).—See Clinical Cases.

INJURIES OF THE HEAD.—PLATE XLIII.—Page 866.

Fig. 1. Intra-cranial extravasation of blood from injury of the middle meningeal artery, in a case of fissure of the cranium. The symptoms were at first those of concussion: the symptoms of compression came on rapidly after reaction set in. From original sketch by Dr. James Moore.

Fig. 2. Fungus cerebri following a compound comminuted fracture of the cranium caused by gunshot. (Case of A. Boswell. See Clinical Cases, page 922.)

Fig. 3 is a sketch of the brain from the same case. A section has been made which exhibits the relations of the fungous protrusion, and the cavity of an abscess, filled with broken-down clots and pus, in the brain-substance at the base of the fungus. (Sketched by Dr. Lauder).

Fig. 4 shows intra-cranial suppuration arising from a blow on the cranium. The purulent collection is placed between the bone and dura mater, whilst a collection of unhealthy sanious pus corresponding to the internal suppuration is situated externally between the bone and pericranium, constituting Pott's Puffy Tumour. Dr. Caton.

INJURIES OF HEAD, FRACTURES OF THE CRANIUM, AND OPERATION OF TREPAN.—PLATE XLIV.—Page 896.

Fig. 1. Diagram to explain the views of Mr. Vincent as to the direction of the impulses on the contents of the cranium from blows inflicted at different parts of the skull. See page 862.

Figs. 2 and 3 are views of the interior and exterior of a sharply-depressed fracture, supposed to be caused by a blow with a hammer such as is used for breaking stones. The faint dotted line in Fig. 2 indicates the position where the base of the depressed fragment should be sawn across, to enable the surgeon to remove it without using the trephine. See Lecture xciv, page 898.

Fig. 4. Sketch from John Bell's *Surgery*, illustrating the advantage of using the cranial saw instead of the trephine in certain cases. See Clinical Cases, page 928.

Fig. 5. Sketch from Sir Charles Bell, showing the result of the operation of trepan. The plan in this figure shows the fracture from the interior, and its relation to the circle of bone removed to allow of the fragments being removed or elevated.

Figs. 6 and 7 are portions of cranial bones removed by the trephine to exhibit the varying thickness of the cranium in different individuals and in different parts of the same skull.

Fig. 8. Necrosed bone thrown off from the circular opening made with the trepan.

Fig. 9. The instrument termed the trephine.

Fig. 10. The trepan.

TUMOURS OF THE UPPER JAW.—PLATE XLV.—Page 980.

Fig. 1. Malignant fibro-plastic tumour of the upper jaw, implicating the textures of the cheek. The upper jaw of the right side and a portion of palatine plate of the left side, together with soft textures of the cheek, were removed by operation. A flap was dissected from the neck to fill up the gap, as shown in Fig. 2. The wound healed well, and the patient was dismissed in good health, with wonderfully little deformity of the face. But a similar growth, I understand, appeared in the left antrum about a year afterwards, in consequence of which she died. (Sketched from nature by Dr. Caton. See Clinical Cases.)

Fig. 5. Very large firm fibroid tumour of the upper jaw. The tumour, as shown in the sketch, projected very largely into the mouth. The whole jaw was removed, and the patient made an excellent recovery. The result is shown in Fig. 2, Plate XLVI. From original sketch by Dr. John Smith.

EXCISIONS OF THE JAWS.—PLATE XLVI.—Page 984.

Fig. 1. Sketch of Elizabeth Fitzpatrick, in whom both sides of the jaw were removed, leaving only the symphysis. See Clinical Case, page 1059.

Fig. 2. From a photograph showing the result in the case represented in Plate XLV., Fig. 3. The contraction of the features and the deep shadows caused by the light during the photographic process give an unfavourable view of the actual result.

Fig. 3. From a photograph. Result in the case of Mrs. H——, in whom one-half of the lower jaw was removed by disarticulation and resection. In this case also the shadows might mislead as to the extent of the incision, as a deep line extends completely under the chin. The incision terminates considerably to the right of the chin. In other respects the sketch gives a good idea of the result.

TUMOURS OF THE NECK.—PLATE XLVII.—Page 1002.

Fig. 1. A tumour situated in the superior anterior angle of the neck, pressing aside the sterno-mastoid. The tumour really occupied a very deep position, being an outgrowth from the thyroid body. This is one of the cases referred to at page 1004.

Figs. 2 and 3. Enormous deep-seated tumour of the face and neck. Case of Mr. Jepson. See Clinical Cases. A lateral sketch of the same case is given as a contrast with a malignant cervical tumour at page 112.

PLATE XLVIII.—Page 1074.

Figs. 1, 2, and 3. Engraved from photographs of the lad Manson, showing the position of the deep cervical growth and the result of the operation. See Clinical Cases.

DISEASES OF AIR-PASSAGES.—PLATE XLIX.—Page 1010.

Surgical anatomy of the parts concerned in tracheotomy in the child.

Fig. 1. The skin, platysma, and fascia have been reflected, exposing the sterno-hyoid and thyroid muscles, and the intermuscular line, on either side of which the central jugular veins pass down to converge in the supra-sternal fossa.

Fig. 2. Deeper view of the same region. The intermuscular tissue has been divided, and the sterno-hyoid and thyroid muscles are held aside by hooks. At the upper part of the dissection the thyroid cartilage is exposed, less angular and prominent than in the adult. Below it we see the thyroid body, connected with which, on each side, we see the lateral prolongations of the thymus gland. The deep thyroid veins are seen partly overlapped by the thymus gland, and immediately below the isthmus of the thyroid body, and between the veins, the trachea is seen bare at the point where it should be opened in tracheotomy. Externally to the prolongations of the thymus gland portions of the common carotid arteries are exposed to show the close relation of these vessels to the trachea. (Drawn from nature by J. Noble. See pages 1045 and 1046.)

TRACHEOTOMY.—PLATE L.—Page 1046.

Fig. 1. Sketch from nature, showing a plum-stone firmly impacted in left bronchus. Lecture, page 1046 ; also Clinical Cases, page 1085.

Fig. 2. Sketch from nature, showing occlusion of larynx and upper part of trachea by false membrane. Tracheotomy was performed with marked relief, but the disease extended to the trachea and bronchi below the opening, and proved fatal. See case of D. R., in Clinical Cases, page 1090.

Figs. 3 and 4. The form of trachea-tube recommended.

Figs. 5 and 6. The double spring hook for keeping the incision open to facilitate the introduction of the tube, or to allow the child to cough up portions of false membrane before the tube is introduced. The instrument is figured closed, and also with the blades expanded.

HERNIA—HÆMORRHOIDS.—PLATE LI.—Page 1168.

- Fig. 1 exhibits the appearance of parts, in a case of gangrenous hernia, after removal of the mortified portion of bowel. The upper and lower orifices of the intestinal tube are seen, and the valve-like fold of the mucous surface between them. (Case referred to at page 1117.)
- Fig. 2. Portion of gangrenous intestine. A large ulcerated opening is seen at one part below the constriction.
- Fig. 3. Portion of gut with numerous small perforations, resulting from a slower form of gangrene. In this case, the patient, an old woman, went on very favourably for some days, when she was suddenly seized with acute peritonitis, which had been caused by the escape of the feculent matter by the minute perforations. Page 1158.
- Fig. 4. Hæmorrhoidal protrusion of congested folds of mucous membrane at the anus. This form of disease has sometimes been confounded with prolapsus ani. See page 1387.

HERNIA.—PLATE LII.—Page 1190.

- Sketches after Sir Charles Bell, showing the steps of the operation in oblique inguinal and in femoral hernia in the female. Fig. 3 shows very well the appearance presented by a femoral hernia, when the skin and superficial fascia are freely divided.
- Fig. 1. A view of the operation for hernia, descending into the labium. From being an inguinal hernia, the intestine had descended to become a hernia resembling the scrotal hernia of the male, only that it is contained in the labium. A B, The extent of the herniary tumour. C, From this to B, is the course of the first incision, which cuts through the skin and cellular membrane, and exposes the fascia. D, The fascia which covers the proper sac of the hernia. After dissecting off some lamina from it, it is pinched up by the forceps, and the knife being carried horizontally on the surface of the tumour, this layer is cut through; then the director is pushed under it. E, The director pushed under the fascia, to ascertain its nature. Along this the knife is run, laying open the proper peritoneal sac. F, The peritoneal sac, smooth; and so transparent that the intestine gives it a darker hue.
- Fig. 2. In this plate we have a view of the second stage of the same operation. The peritoneal sac has been cut up, and now the intestine appears. A, A portion of the small intestine, which seems to have been the original contents of the herniary sac, and which had here suffered less by the incarceration. B, A portion of the great intestine, which had descended more lately, and had been the cause of strangulation. It is known to be a portion of the great intestine, from the greater size, the cellular form, and the

fatty appendages which hang from it. The manner in which these portions of the intestines rise and cover the ring, may give the surgeon an idea of the difficulty which sometimes occurs in cutting the stricture.

- Fig. 3. This plate represents the manner in which the femoral hernia will sometimes rise from the depth of the groin, when freed of the integuments and the binding of the fascia. A B, The extent of the incision of the integuments. C C, An aponeurosis dissected off the proper sac. D, The hernia covered by the proper sac. The tumour is of a pyramidal form. E, A cut through the sac.

LITHOTOMY.—PLATE LIII.—Page 1256.

- Fig. 1. Patient secured in the position for the operation. The dotted line marks the course and extent of the lateral incision.
- Fig. 2. Lateral view of the perineum and pelvis, showing the position of the knife in cutting into the groove of the staff. The dotted lines indicate the staff and the extent of the prostatic incision. These sketches are reduced from original drawings from nature, by Dr. John Smith.
- Fig. 3. Staff, knife, and forceps used in the operation.
- Fig. 4. The loop-bandage for securing the wrists to the middle of the foot, as in Fig. 1.

PLATE LIV.—Page 1258.

- Fig. 1 shows the direction in which the forceps should be introduced to seize the stone.
- Fig. 2. Direction in which extraction should be effected.
- Fig. 3. Use of the scoop in removing small calculi or fragments of a stone.
- Fig. 4. Position of the lithotomy tube. When the tubes are secured the external orifice of the tube should be raised so as to depress the point into the 'bas-fond' of the bladder.
- Figs. 5, 6, and 7 indicate the position of the knife and finger in the method recommended for facilitating the entrance of the knife into the groove of the staff at proper points. See page 1260.
- Fig. 8. The bulbous searcher.
- Fig. 9. Scoop and lever.

PLATE LV.—Page 1259. (To follow immediately the preceding Plate.)

- Fig. 1. Dissection of the parts in a case in which the lateral operation had been performed. The track of the incision is seen gradually narrowing from the external wound to that in the prostate; the staff is seen bare where it had been cut into just in front of the prostate. The lateral lobe of the prostate gland covered by the prostatic

fascia is shown in relation to the reflexion of the ileo-vesical fascia, which is seen to be entire.

The dark dotted line marks the upper line of the track of the incision; above that line the parts have been dissected to show the relation of the bulb and Cowper's gland to the incision. In the track of the wound the contour of the rectum is shown—the gut being somewhat distended with tow. Plate LVI. gives a view of the same parts in the child, and the letters of reference there given will serve to indicate the points in this plate.

Fig. 2. The prostatic incision as seen from within after the extraction of the stone. In this instance the stone was considerably above the average size. These sketches are reduced to about two-thirds of the natural size.

Fig. 3 shows the incision of the prostate after extraction of the stone, when all the fascial textures have been removed. This view was obtained by operating on the dead subject, an adult, and dissecting the fascia from off the gland. It shows that the texture of the gland splits up in the line of the incision under the action of the finger.

PLATE LVI.—To face Page 1261.

Dissection of the parts in a child; this outline sketch is of the full natural size, and shows the high position of the bladder in the child.

a a, Section of the pelvic bones; *b*, the portion of the penis and urethra; *c*, the urinary bladder; *d*, section of the soft tissues of the perineum and hip; *e*, the track of the wound; *f*, the prostate gland, showing the opening made in it, and in the membranous portion of the urethra; *h h*, the rectum: the general course of that intestine can be traced, and a dark outline marks its position in relation to the wound made in lateral lithotomy.

PUNCTURE OF BLADDER—IMPERFORATE ANUS.—

PLATE LVII.—Page 1330.

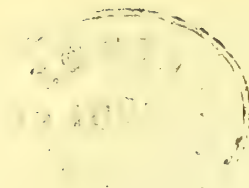
Fig. 1. Method of opening the membranous part of the urethra described at page 1331. The forefinger of the left hand is seen projecting the anterior wall of the rectum, and so as to feel the anterior part of the prostate, and the knife is being entered into the membranous urethra just in front of the finger of the left hand. The line marked *A* indicates the point for puncturing the bladder from the rectum. *B* indicates the line and point for puncturing from above the pubes.

Fig. 2. Operation of puncturing the bladder from the rectum, as described at pages 1329 and 1330.

Fig. 3. Operation for imperforate anus. See page 1398

HERNIA.—Clinical Case.—PLATE LVIII.—Page 1410.

View of the parts in a case of femoral hernia, in which the irregular obturator artery constricted the hernial protrusion, and required to be tied and divided to relieve the constriction. The distal end of the obturator artery is obliterated, and the ligature has separated. The ligature still remains on the proximal end of the artery, which is much diminished in size, whilst the epigastric is proportionately enlarged. See Clinical Cases.





SPECIAL OPERATIONS.

LECTURE LXXIV.

Operations : necessary Precautions regarding them—Preparatory Examination and Treatment of Patient—Points of Detail in reference to collateral Arrangements—Use of Anæsthetics : Hints and Cautions with regard to their safe Administration—Plans for the Operations—Assistants—After-Treatment of Patient.

IN entering on the department of the course which includes the greater surgical operations, I think it right to bring before you, in a suggestive form, the consideration of certain points which require to be attended to, if we would obviate sources of danger and secure a successful result.

Dexterity, care, and precision in performing an operation are most important elements of success. But there are other conditions which, if neglected, may mar the success of the most dexterously-performed operation. The conditions I allude to may be embraced and briefly discussed under the following heads :—

1st, The preparation of the patient by suitable preliminary treatment. 2d, The arrangements for the operation. 3d, The use of anæsthetics. 4th, Certain general principles to be attended to in all operations. 5th, The after-treatment.

1. In former times the preparatory treatment of patients about to undergo operations was a very formidable matter. A system of "training" by medical treatment, diet, and regimen, was carried out with extreme care, and so prolonged that it often induced evils of a different kind, but quite as dangerous as those which it was intended to obviate ; and hence, as is very often the case, this

extreme led to the opposite—the neglect or disuse of preliminary treatment. An operation, however slight or simple it may appear to the surgeon, must always be to the patient a source of great anxiety and distress. When, therefore, an operation is decided on, the less unnecessary delay and suspense the better, as the patient in the interval is liable to become nervous, depressed, and less fitted for the ordeal. Whilst, however, prolonged preparation is to be avoided, a certain period of delay is necessary in most cases of operation, except in those cases where it is required for the results of injury or other urgent causes. Thus, in the case of patients who are brought from a distance, or those admitted into hospital, it is advisable that some days should elapse before they are submitted to operation, not only that a period of rest may be afforded, but also that the surgeon may have an opportunity of carefully examining the state of the patient, and conducting the preparatory treatment accordingly. In all cases a careful examination of the chest should be made, and the state of the abdominal viscera should as far as possible be ascertained. The condition of the tongue, skin, pulse, alvine excretions, and urine, requires to be carefully attended to. If the skin be hot and dry, the tongue foul, and the secretions unhealthy or diminished, or if irritative fever be present, the operation should be delayed till these conditions have disappeared. Rapidity of pulse, and debility arising from hectic depending on the disease which requires the operation, form no reasons for delay, but rather indicate the necessity for the operation being performed to remove the cause of the hectic. In cases where the urine is albuminous, we should test it frequently, and at different periods of the day, to ascertain whether the condition is temporary or persistent, and delay operating until we have thoroughly investigated whether there be any extensive organic disease of the kidneys or not. When there is much lumbar pain, urine scanty, coagulable, and accompanied by cedema, the condition is a contra-indication to operation ; but by dry cupping and cataplasms over the lumbar region, and the use of diaphoretics, mild diluent drinks, and gentle purgatives, this

condition, if it depends on temporary congestion of the kidney, may yield to treatment, and then the operation may be performed with a reasonable hope of success. In cases of disease in which irritative fever or much suppuration has been long present, or in cases of malignant tumours, there is a great tendency to blood-contamination, and hence prophylactic measures to diminish the risk of pyæmia should be had recourse to before as well as after the operation. The prophylactic remedies in which I have most faith are preparations of iron and chlorate of potash in moderate or small doses, so that they may mix with the food and enter into the formation of the blood. If given in large doses, they simply irritate the bowels, and are rapidly carried off by the alvine and urinary secretions and excretions. In performing operations on females, we should studiously avoid the catamenial period, and if present wait till it has passed. The patient is generally more excitable and irritable during the menstrual period; and even in cases in which operations have been performed previously, an unfavourable change is often noticeable during that period, healthy action in the wound being restored as the discharge ceases. At the same time, whilst it is well to observe this precaution in ordinary cases, the presence of the catamenia should never be a bar to the performance of operations of urgency. Whilst I have thus instanced some of the conditions to be specially attended to; in a large proportion of cases, all that is required is to give the patient some gentle alterative or a mild purge a day or two previous to the operation, and to regulate his diet, so that the digestive organs may be in a favourable state.

2. ARRANGEMENTS FOR THE OPERATION.—In hospital practice, a theatre designed with a special view to the performance of operations, well lighted, and furnished with suitable tables, and all other appliances, together with the existence of an organised staff of medical assistants and nurses, render the arrangements for operations so methodical, simple, and apparently routine, that the requisite details and the forethought required in making the arrangements are scarcely noticeable to students who witness

operations. Hence I consider it more necessary to draw your attention to what forms a most important condition for the proper performance of an operation, and specially so in private practice, where everything must depend on the forethought and careful directions of the operator. In all cases of operation not arising in emergencies, it is desirable that the proper arrangements should be made beforehand, so that nothing be left to be done in the confusion and excited state in which a private family generally is on the day of the operation. As all the necessary requirements are simple and easily obtainable, the arrangements can be made without any parade or alarm to the patient, whilst much time and annoyance is thereby saved both to the family and the operator. If the bedroom of the patient be tolerably large and well-lighted, it is advisable that the operation be performed there, as appearing less formidable than transporting the patient into another room. In all great operations I consider it most essential that the patient be placed upon a table to undergo the operation. This enables the operator and his assistants to act more easily in concert, to obtain better light, and to get rid of all appearances of the operation when it is completed ; and, what is my special reason, it secures greater safety to the patient. Some object to this as unnecessary, and say that in most cases the operation had better be performed in bed, as less disagreeable to the feelings of many patients, and as causing "less fuss." Now, my experience is that eventually it always causes "more fuss." It is not easy to get at the patient ; the assistants get crowded and awkwardly placed, blood can hardly be prevented soiling the patient's night-dress, and the bed-clothes and the bedding generally get disarranged, so that the after comfort of the patient is interfered with. All this and more serious consequences are avoided by placing the patient on a table, and there is no need for him knowing anything of it. He is put under chloroform in bed ; the table is easily arranged in another room, and brought in when the patient is unconscious, and he is lifted from bed and placed on the table. His bed is then properly arranged, so that he is afterwards placed in as comfortable a condition as his circumstances

admit of, and after the operation the table and all the other paraphernalia of the surgeon are at once removed. Supposing the room to be fixed on,—the surgeon chooses a firm table of moderate height, not very broad, and of sufficient length to support the patient. An ordinary stout deal table generally answers all purposes. This table is covered by a folded blanket, protected by oil-cloth or India-rubber web, and furnished with a couple of pillows to support the patient's head. A piece of floor-cloth or old carpet should be placed over the carpet of the room, under and for some distance from the table, to protect the carpet from being stained with blood. In cases of amputation, where there may be considerable effusion of blood, or discharge from the diseased limb, the surgeon should direct the friends or nurse to provide a tray with sawdust, so as to avoid all disagreeables as far as possible, as the sawdust absorbs the fluids, and prevents the risk of their accidental diffusion over the floor. The other preparations to be provided by the family are basins in which to wash the sponges; and plenty of towels, hot and cold water, and a foot or slop pail, into which the soiled water may be emptied. Hot bottles should be ready when the patient is replaced in bed after the operation. The surgeon should never trust to finding sponges provided; he should invariably bring his own, otherwise he will sometimes have to deal with very doubtful articles. In my own practice, I am very particular in regard to sponges. Before being used they should be thoroughly cleansed from all sand or calcareous matter, and after every operation I have my sponges washed in a weak solution of bicarbonate of soda, to remove the blood thoroughly, then in cold water, and lastly, I allow them to steep for a night in a weak mixture of water and hydrochloric acid, and in my private practice I seldom use the same sponges continuously, or for any long period. The number of assistants required will depend upon the nature of the particular operation. In cases of emergency we must do the best we can with what assistance can be procured, but in pre-arranged operations the surgeon should consider what assistance is required, and arrange the number of attendants and their duties

beforehand. Whilst there is no necessity for a large number of assistants, there is often an error committed in having too few, and trusting to unskilled aid, which sometimes fails when most wanted. The patient need never see any one but the operator, and the assistant who administers the chloroform. When he is under the chloroform the other assistants are introduced to lift the patient upon the table, and take the places previously assigned to them. By a little forethought and preconcerted action much bustle is saved. The instruments and dressings required in the operation are prepared beforehand, and arranged on a small tray in another room, whilst the patient is being chloroformed. As a general rule, it is advisable that the after-dressings, ligatures, suture-needles, and the like, be placed on a separate tray from the instruments used during the operation. For night operations small wax tapers should be at hand, as being more manageable and giving a clearer light than a flaring candle. I have found these tapers so useful that they form part of the furnishings of my emergency bag.

3. THE USE OF ANÆSTHETICS is now almost uniformly adopted in all important operations, and the cases in which they are objectionable are so very few and exceptional that they will be better understood when speaking of special operations. I do not intend to enter upon the general question of anæsthesia and anæsthetics; that has been so fully discussed by my distinguished colleague, the late Sir James Simpson, that I need only state what I have found to be the most efficient and safest method of exhibiting them in cases of operation. I would, however, observe, as regards their risks, that whilst we could scarcely expect that an agency so potent as to dull or arrest temporarily all consciousness, should be perfectly free from danger in some cases, or if not carefully watched in its action, yet, when we take into account the many thousand cases in which anæsthetics must have been administered, and the comparatively few cases in which fatal results have occurred, I think we may safely say that few powerful narcotic remedies are so free from danger. And it has been frequently remarked that the great majority of the fatal results have occurred during the

performance of slight operations, and when the patient has been placed in the sitting posture. At the same time, all due precautions should be taken, such as examination of the circulatory organs in suspected cases, and preparation of the patient prior to the operation. When the patient has a weak heart and feeble pulse, or is advanced in life, I usually mix a little anhydrous sulphuric ether with the chloroform, or begin by the administration of chloroform, adding the ether if the pulse shows a tendency to flag. The stimulating effect of the ether under such circumstances is very noticeable; although for general use the chloroform answers far better. As to the quantity to be administered, that must be judged of by the effect. I would only remark that there is often greater danger from beginning with small quantities than by bringing the patient rapidly under its influence. Measurement of the chloroform used, is merely to give an appearance of precaution, and, I presume, to enable the surgeon to be prepared for a coroner's inquest.

In the Edinburgh Infirmary no special apparatus is employed; merely a folded towel or handkerchief; or, when the "drop system" is adopted, a single fold of the handkerchief or cloth is placed over the mouth and nostrils, the face having been previously smeared over with lard or oil to prevent the skin being irritated. When the ordinary method is employed, the handkerchief is folded into a hollow cone, into which the chloroform is poured so as to wet the interior, and the cone is then placed over the mouth and nostrils. When renewing the supply of chloroform in this method, it is advisable not to remove the cone from the mouth, but merely to open up a part of the outer fold and pour the chloroform on the inner fold. When the "drop system" is used, a little chloroform is poured on the handkerchief at first, and then continuously applied, drop by drop, till the full effect is produced. When a patient is to be operated on under the influence of chloroform, no food should be given for at least three hours before the operation, so as to allow the stomach to be empty, and thus diminish the inconvenience and risks of

vomiting. A little brandy, diffused in a small quantity of water, may be taken about quarter of an hour before the chloroform is inhaled. This is useful both as a stimulant to the circulation and also in obviating flatulence, which is apt to occur in some patients when the stomach is empty, and, when present, leads to retching and attempts at vomiting. In the Royal Infirmary, where the usual hour for operations is twelve o'clock noon, the patient gets a light breakfast about a quarter to eight o'clock, so that fully four hours elapse before the anæsthetic is administered. I have spoken of the *risk* of vomiting, for there is great risk of a portion of the vomited matter passing into the larynx, and leading to suffocation, as the symptoms of asphyxia might be attributed to the chloroform, and time lost in attempting artificial respiration. In cases of hernia, where vomiting is present independently of the effects of the anæsthetic, great attention is required on the part of the assistant to keep the patient's head and neck lying on the side, so as to allow the vomited matter to pass easily from the mouth, which it cannot do when the head is lying back. When, after an attack of vomiting, sudden symptoms of asphyxia occur, I think the proper plan would be at once to perform laryngotomy in the crico-thyroid space, and allow air to enter the trachea; because, if any solid matter has entered the larynx or trachea, the peculiar sensory and expulsive powers being diminished during anæsthesia, the foreign body is not expelled, as it might be under ordinary circumstances.

In all cases of important operations the patient should be placed recumbent. All articles of dress which constrict the neck or waist, or may in any way impede the free movements of the chest or abdomen, should be loosened or removed. The state of the pulse should be ascertained before beginning the inhalation, and carefully watched throughout. Immediately before applying the chloroform, the patient is desired to take a deep inspiration, and then to continue to draw in full breaths quickly after the chloroform is applied. By doing this, less chloroform is required to produce the desired effect, and the assistant administering it watches carefully the effects produced. In almost all cases there

is more or less struggling just before the patient gets fully under the effect of the anæsthetic. Then the breathing becomes stertorous, but regular; the eye and eyelid insensible to the stimulus of touch, and the limbs become flaccid. The symptoms which indicate danger are—extreme lividity, irregular gasping breathing, but more especially pallor, and irregular weak pulse, or sudden cessation of the wrist pulse. Stertorous breathing, so long as the respirations are regular, is not necessarily a symptom of danger, it merely shows that the patient is deeply under the anæsthetic. The chloroform cloth may be removed to a greater distance from the mouth to allow free admixture of air, or its use may even be intermitted; but unless the breathing be irregular, or become stridulous or gurgling, with increased lividity of the face, there is no need to interfere.

When the breathing becomes irregular, gasping, gurgling, or very stridulous, and the face livid, remove the chloroform, draw forward the tongue, pass the finger into the mouth to clear away any mucus over the glottis, push away the uvula and soft palate upwards to avoid its interference with the opening of the larynx, and sprinkle cold water on the face and chest, or flip the surface with the end of a wet towel. At the same time, artificial respiration, by means of gentle and regular pressure on the walls of the chest, not too forcibly or rapidly applied, should be used; or the same end may be effected by the assistant drawing the arms upwards above the head, and then pressing them down by the sides of the patient, so as to make alternate compression and expansion of the parietes of the thorax. Whenever the lips or face are seen to become pale, and the pulse to flag in strength or to become irregular, the chloroform should be stopped, and sulphuric ether substituted, cold water sprinkled on the face, and artificial respiration begun. The case is one of imminent danger. Whilst these means are being used, a small enema of brandy and warm water should be administered as a stimulus. If the patient be carefully watched, and the administration of the ether begun when any weakness of pulse is noticed, it will generally suffice

to restore the force of the circulation, and prevent the accession of the dangerous symptoms. Galvanism has been recommended and used. If applied, the current ought not to be directed through the chest, so as to affect the heart, or it may do more harm than good. It should be applied to the cervical region, so as to pass along the course of the phrenic nerve. But I should hardly advise its use, as it is likely to interfere with the other and more efficacious measures for resuscitation of the patient.

In my own practice I have met with one fatal case resulting from chloroform. The operation—amputation of the penis—was effected with one stroke of the knife. No blood flowed, the pulse at the wrist had ceased in an instant, and all efforts to resuscitate failed. Breathing, though of a gasping character, was present when the artificial respiration was commenced. In another case, in which I was assisting, I had my finger on the posterior tibial artery. The patient was just brought under the chloroform, and the operator had entered the knife through the skin, when the pulse, without any previous diminution in strength, ceased to beat. In both these cases there was fatty heart. I have, however, both in my own practice and that of others, seen some patients, who seemed to be in a fatal syncope, resuscitated by the measures I have advised. Almost all the cases in which the dangerous symptoms occurred were cases of slight operations. But, after all, the risks of danger are very small if the administration be watchfully and properly carried out.

As to its after-effects, the worst are the nausea and vomiting which often result from its employment; and in some operations, such as hernia, this vomiting may prove serious. In most cases, sucking a little ice, or a dessert-spoonful of iced brandy and water given occasionally, and the application of a sinapism over the epigastrium, serve to relieve the sickness. When the nausea and retching continue, a draught of tepid water, to assist the effort of vomiting to empty the stomach, is often of use, and this may be followed by a small opiate to allay

irritation and procure rest. It has been stated that, whilst the use of chloroform and other anæsthetics has done so much to facilitate the performance of operations and save the patient from suffering, they have given rise to greater danger after the operation, that the mortality is increased, that cases do not get on so well as formerly, and that pyæmia especially is much more heard of now than before anæsthetics were used. All this is mere assertion, without any distinct proof. And as I have had experience in performing and witnessing operations, both before and since the use of chloroform, I feel satisfied that the very opposite is true; that operations are very much more successful in their results than before the use of anæsthetics. The patient is saved both the physical and moral shock inseparable from great operations formerly, and which depressed him and exercised an influence for evil on the result. I was amongst the first to use chloroform in a great operation in November 1847; and since then I have used it, and seen it used, in almost all operations, great or small. I feel satisfied that, instead of diminishing, it has greatly advanced the successful results of operations. It is true, we hear more about pyæmia now than we did thirty years ago, because the name is comparatively a new one; but the same condition existed under different titles:—exhaustion, surgical fever, secondary abscesses, icteric irritative fever after operations, rigors, from exposure at “open windows” (a condition once remarkably fatal in “successful cases”), and acute sinking—will be found to correspond wonderfully in symptoms, results, and morbid appearances, to the modern pyæmia. Indeed, it is only of very recent date that some surgical authorities have admitted the term pyæmia into their vocabulary—“exhaustion,” or “acute sinking,” having been found to answer all purposes equally well.

4. THE OPERATION.—The general principles to be attended to must be very briefly stated here, for so much depends on the nature of the operation, that they are better brought out in their relation to special operations. The plan or method

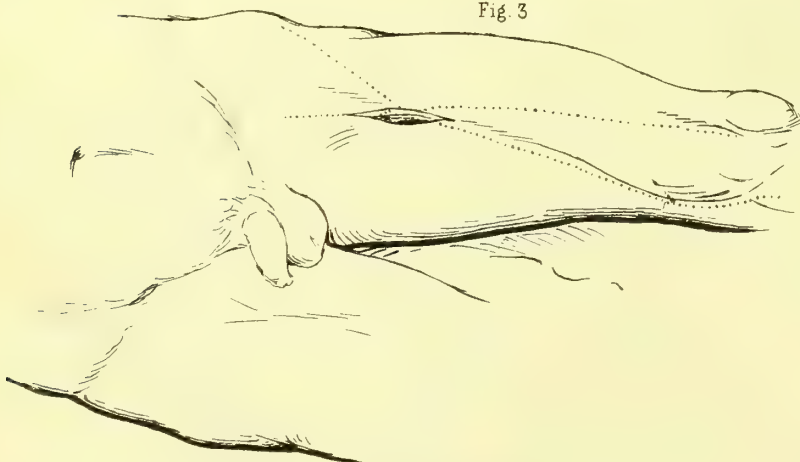
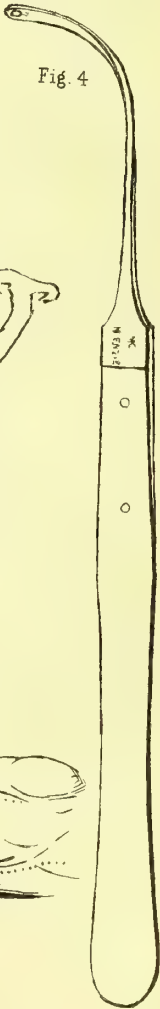
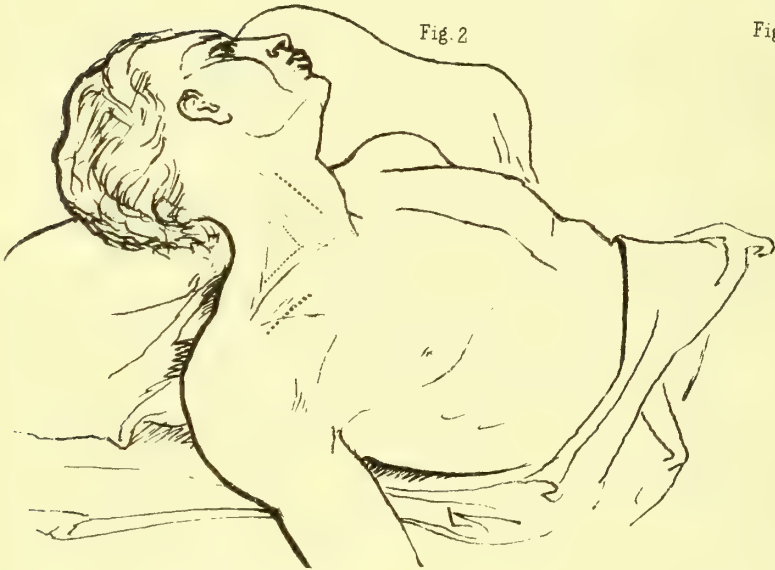
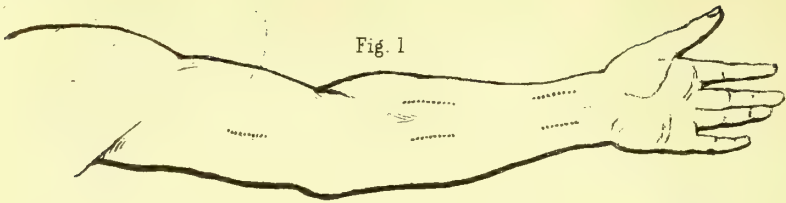
of operating should be carefully considered and decided on beforehand, so that the incisions may be effected rapidly (not hurriedly), with decision and precision, every touch of the knife telling towards the accomplishment of the object in view. If the plan be not decided on, confusion, and a want of decision in operating, and loss of time, will be the almost inevitable result. If the steps of the operation be duly planned beforehand, all will be executed with decision, simplicity, and safety to the patient. The assistants should have their several duties assigned beforehand, and their places arranged, so that they may not interfere with the operator, or each other, but that all may act in concert. The incisions should be free, deep, and directly from the surface towards the deeper parts, without lateral dissection, except in particular operations, such as those for the removal of tumours. In certain operations where it is important to recognise readily the deep textures, such as in hernia, ligature of arteries, or in the removal of some tumours, it will save time in the end to pause and secure the small vessels which bleed, so as to prevent oozing of blood into the deep part of the wound, which, by infiltrating the cellular tissue, renders it difficult to recognise textures. Besides, small vessels, which are easily seen and tied at first, soon cease to bleed actively during the operation, and are consequently often left unsecured, and bleed again on reaction taking place; and in cases of hernia, or in other operations near the great cavities or canals, they may bleed into the cavity and give rise to serious risk. When the operation is completed, the wound should be washed by pouring first tepid and then cold water, from a jug, over its surface, to remove all clots and arrest oozing. The edges of the incision are then approximated by points of interrupted suture, or harelip suture. In some cases we only introduce the sutures, leaving the ends long without tying them, so that if any oozing occurs it may be noticed and arrested. After six or eight hours, any clots of blood which may have formed are gently removed with a bit of soft sponge and by syringing out the wound, and then the incision is finally closed, and the local treatment conducted on the

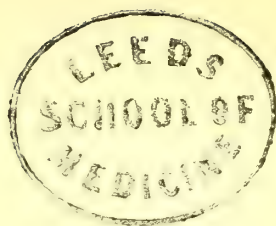
principles laid down when speaking of incised wounds (Lecture xxvii.)

5. CONSTITUTIONAL AFTER-TREATMENT.—When the patient awakes from the chloroform, an opiate is given to allay pain and to prevent the restlessness which would otherwise be sure to take place. Should sickness from the chloroform supervene, as already stated when speaking of anæsthetics, I advise the use of tepid water to render the efforts of vomiting less violent, and to empty the stomach, and then a little brandy in iced water may be given. If the nausea continue, a sinapism applied to the epigastrium, and a little ice kept in the mouth and slowly sucked, or small quantities of iced aërated water, will usually arrest it. In some cases, where the patient does not vomit, the nausea may continue for some time, and, unless attended to, may prove troublesome by depressing the patient. During the progress of the case opiates are given at bed-time, if required to obtain sleep, but the sooner we can dispense with their use the better. In some patients, in whom there is much nervous excitement, the use of the bromide of potash in 30-grain or 40-grain doses, at bed-time, is often of great service in procuring sleep, and enabling us to dispense with opiates. As to diet, it should be simple, light but nourishing, and given at first in small quantities, frequently. For a day or two it is probable the patient may not be able to take anything but milk diet. Milk beat up with the white of eggs and a little lime-water will often remain on the stomach when all other food is rejected, and milk with aërated potash water is also much relished by patients. So soon, however, as the patient can bear it, strong beef-tea, with extract of beef, should be given, or a little white fish, and afterwards, as the appetite improves, chop or steak is preferable to slop diet. As regards the exhibition of stimulants, that must be regulated by the condition of the patient, the state of the pulse, and the appearance of the wound. No routine practice should be followed. In my hospital practice I find myself forced to give stimulants largely, owing to the exhausted state of the patients, their inability to take nourishing

food, and not unfrequently from their previous habits, or from want of action in the wound. In private practice stimulation is not often needed, and I feel satisfied that the routine practice of giving stimulants in all cases of great operations is not only unnecessary but dangerous, as over-exciting the circulation, keeping up the pulse, and proving detrimental to internal organs. If the patient has a moderately firm pulse, and can take nutrient diet, the amount of wine or brandy he requires is very little, if any.

Should the pulse keep high, or show a tendency to rise, the remedy of all others which I have found of most use as counter-acting this condition, and relieving the febrile state which accompanies it, is the tincture of aconite (*Fleming's*) in half-minim or minim doses, every three or four hours, watching its action carefully, and leaving off its use whenever the pulse lessens in frequency. During the after-progress of the case, when the tongue is clean, the use of quinine with compound infusion of gentian, and either dilute hydrochloric, nitric, or nitro-muriatic acid, will be found of use as tonics; and in cases where there is any want of action in the stump, the exhibition of such tonics is often attended with marked benefit. In very weakly strumous patients, or where, from the nature of the disease requiring the operation, we dread pyæmia supervening, the muriated tincture of iron, and moderate doses of chlorate of potash, may be given; but should the iron produce nausea it must be abandoned. Of course the state of the bowels and the urinary secretion must be carefully attended to during the progress of the case; and at first, shortly after the operation, the action of the bowels should be assisted by enemata to prevent straining; and, after ligature of great arteries, or in the larger amputations of the lower extremity, the same precaution should be used at the period when the main ligatures may be expected to separate.





LECTURE LXXV.

Operation for the Ligature of Arteries—Importance of a Knowledge of the Relative Anatomy of the Part to be operated on—Nature of the Incisions required—Exposure of Artery : Opening of Sheath—Passing of Needle—Apparatus required.

Ligature of Innominate Artery—Ligature of the Common Carotid Artery—Ligature of the First Part of the Subclavian Artery.

As I have fully discussed the effects of ligature of arteries, and the injuries and diseases of the arterial system which require surgical treatment, I now proceed to describe and demonstrate the operative procedures for applying the ligature to the principal arteries. It is not my intention to describe the various methods which have been adopted by different surgeons, but rather to employ the time allotted to this part of the course to careful and accurate demonstration of the points most essential to be attended to, in what from experience I have found to be the best plans of procedure. In every surgical operation a thorough knowledge of the structure of the parts to be operated on is necessary ; but in very few operations is it so necessary as in those performed with the view of reaching and tying important arteries. In these operations it is generally amongst organs of vital importance that the surgeon has to direct his instruments, so that by carelessness or the least deviation he may wound structures essential to life. And in all cases, uncertain and difficult manipulations, if they do not lead to immediately fatal accidents, are almost sure to be followed by secondary hæmorrhage.

Surgical anatomy, then, consisting of an accurate knowledge of relative anatomy, and of the functions of the different structures likely to be implicated in the operation, is the only secure basis on which to practise the operations on arteries. And I shall therefore preface each operation by a brief but careful examination

of the anatomy of the parts, in so far as these have essential bearings on the operative procedure ; whether as affording guides to the vessels to be tied, at different stages of the operation, as enabling us to avoid injury to important structures, or as facilitating the deligation of the artery.

When speaking of operations in general, I stated that the operative manipulations would be better understood when speaking of special operations. I shall now, therefore, state what I consider are the points to be principally attended to in operations for ligature of arteries.

The great object in view is to expose the artery to be tied, with the least possible disturbance of parts, more especially of those parts immediately surrounding the vessel, so as to avoid the risk of secondary hæmorrhage. This object is best accomplished by cutting down directly from the surface towards the vessel, avoiding as far as possible all lateral dissection or separation of the superimposed textures. The superficial incisions should be free, so as to diminish the depth of the wound, and, with a few exceptional cases, this free division of the superimposed textures should be applied to the deeper fasciæ and structures covering the sheath. If this principle be not attended to, the wound becomes more and more contracted as the operator proceeds deeply, till at last, and at the most important stage of the operation, he will find himself working in a deep hole, in which his manipulations are confined, and the textures only imperfectly seen or felt. By attending to the rule of free division, the oozing of blood gets vent externally, the parts are fully exposed, and their position rendered less deep. Even as regards the sheath of the artery itself, opening it somewhat freely, or cutting out an oval portion of it on its superficial aspect, will entail no danger, if the operator is only careful not to separate it largely in clearing the circumference of the artery for passing the ligature. During the incisions all bleeding vessels should be twisted or tied, to avoid the blood infiltrating the textures in the wound. In opening the sheath of the artery, the surgeon should carefully raise a portion in his dissecting forceps, and then either

slit it open for about a quarter of an inch, or, placing the edge of his knife horizontally, cut out an oval portion of the sheath to the same extent. He should next carefully separate the margin of the sheath, and fix it by seizing it with a pair of artery forceps which are left on until the vessel is cleared and the ligature completed. This little manœuvre prevents the original opening of the sheath being lost sight of, should the patient move or the parts get displaced, and it also does away with the necessity for the fingers of an assistant to hold aside parts. The mode of applying the forceps to the edge of the opening in the sheath will be understood by reference to the sketch of the ligature of the femoral artery. Plate xxix. Fig. 2.

When the sheath is thus opened, the surgeon, with the point of the scalpel, clears the circumference of the artery to the extent of a line or two in breadth, so as to admit of the aneurism needle being passed without any force. In passing the aneurism needle, the handle should never be forcibly depressed with a view to make its point project, for that elevates the artery from the sheath and breaks up its fine vascular connections. The needle should merely be insinuated below the vessel, till its point is seen on the opposite side, and then the thread is seized with the dissecting forceps and held whilst the needle is withdrawn, so that all unnecessary disturbance of the artery is avoided. After ligature of the great arteries supplying the extremities, the wound is merely covered with lint, supported by strips of adhesive plaster, and the limb enveloped in a sheet of cotton wadding, and laid on a water pillow or some soft cushion to avoid pressure.

The apparatus required for ligature of arteries is very simple. Besides the ordinary dressings, sponges, and other requisites for all operations, the special instruments needed are a sharp-pointed scalpel or small bistoury, a probe-pointed bistoury, which may occasionally be required; dissecting forceps, artery forceps, and torsion forceps; blunt hooks or bent metallic spatulæ for holding aside the textures; an aneurism needle, armed with fine ligature silk.

Some surgeons, more especially on the Continent, use a grooved director on which to divide the fascial textures and the sheath, but it really affords no safety, and ought to be dispensed with, as the fasciæ in the important parts of the operation are better divided with the hand unsupported and uninfluenced by a mechanical guide.

The aneurism needle should be of the form shown in Plate xxvii., the point rather short from the curve. The eye of the needle should be near the point, and well finished, so as not to cut or fray the ligature. The point of the needle should be smooth and blunt, but not thick, so that it may be easily passed under the artery without risk of piercing the neighbouring vein or other important texture. For the ligature of some deep-seated arteries—as, for example, the subclavian—when the shoulder and clavicle are much elevated, a needle with a double curve may be required, the concavity of the curve nearest the handle playing on the clavicle, so as to enable the point to be passed more easily round the artery, that it may appear at the opposite side without raising the vessel from its connections. If the ordinary aneurism needle, however, be so tempered as to allow some slight degree of flexibility, the surgeon can curve it to suit particular cases. I have always had my own aneurism needles constructed on this principle, and also grooved behind the eye to receive the thread. Not that I consider this of any consequence, but finishing off the groove necessitates care in finishing the eye of the needle, which I have often seen a mere rough perforation.

In cases in which we are about to apply the ligature to an artery for true aneurism, we must be careful, whilst bringing the patient under the influence of chloroform to compress the vessel nearer the heart; for when the patient struggles, and the muscles become rigid, the sac often becomes so tense that there might be a risk of its rupture taking place, unless such precaution were taken.

I shall first describe the operations for ligature of the principal arteries supplying the head, neck, and upper extremity, and afterwards those of the abdomen and lower extremity.

THE INNOMINATE ARTERY, though deeply seated, is not so complicated in its relations, but that it can be readily reached and tied. The vessel is very short—not much more than about an inch and three-quarters in length. It arises from the right side of the arch of the aorta, and passes obliquely upwards as far as the right sterno-clavicular articulation, where it ends by dividing into the right subclavian and the right carotid arteries. It is sometimes called the brachio-cephalic artery, from the distribution of its terminal branches. In its upward course the artery rests for some little distance on the trachea, and is covered by the first bone of the sternum, and by the sterno-hyoid and sterno-thyroid muscles. In this substernal region the artery is crossed by the vena innominata of the left side, which is formed by the junction of the left internal jugular and subclavian veins. Higher up in the cervical region the vena innominata does not cover it. The artery then passes into the lower part of the cervical region, and a small portion of it can be seen by separating the sterno-hyoid and sterno-thyroid muscles. The vessel here lies very deeply, though the textures between it and the surface are not numerous. These are the skin and fascia, with the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and a quantity of loose cellular tissue. It is this part of the vessel that we reach by tracing downwards from the right carotid artery. Its surface corresponds to a quantity of loose cellular tissue and glands, in which lie several large veins returning from the thyroid body. These thyroid veins form a sort of network over the upper part of the space in which the artery lies. The innominate artery is also related to the right vena innominata—the vein being to the right side of the artery, and in close contact with the right side of the vessel is the right pleura.

Operation.—An incision, about two inches long, is made over the inner part of the clavicle, towards the sterno-clavicular articulation, and another, two and a half or three inches in length, along the internal margin of the sterno-mastoid muscle, at its lower part, to meet the former, where it terminates at the sternum. The skin, fascia, and inner attachment of the sterno-mastoid are then de-

tached, so as to be thrown backwards in the form of the flap marked out by the incisions. The internal jugular vein and the root of the right common carotid artery, covered by the deep fascia, are now brought partially into view. The sterno-hyoid and sterno-thyroid muscles should be cut across, so as to expose the deeper parts more fully. The head should be drawn somewhat back, as this allows the innominate artery to be drawn up into the neck, while the left vena innominata, which covers the artery, being fixed by its relations to the right vena innominata and superior vena cava lower down, can scarcely be dragged above the sternum into the right side of the neck. A little deeper dissection is then made, and the artery cleared from the surrounding textures. In doing this great care must be taken to avoid the right pleura, which lies below and to the right side of the vessel. The needle is then passed below it, still taking care to avoid injuring the pleura.

The operator should gently trace the surface of the vessel till he distinctly feels its bifurcation, so as to make sure that the artery exposed is the innominate and not the lower part of the carotid, or in case of any irregularity. In performing the operation on the subject before my class, on one occasion, and inculcating the same precautions as I do now, I could not feel the bifurcation. I therefore desisted from farther interference, and had the subject injected. The preparation is now on the table, and you will perceive that there is no innominate trunk. The right subclavian arises from the left side of the arch of the aorta, passes between the œsophagus and vertebræ, and so arrives at the right side of the neck. When there is any difficulty in reaching the innominate, you will find it by tracing the right carotid down to its origin, the simplest and surest method of reaching the trunk common to it and the right subclavian.

THE COMMON CAROTID ARTERY has been so repeatedly tied for aneurism, erectile tumours, and other causes, that no one would now hesitate to tie it from any fear of the effects which the operation may have on the cerebral circulation.

Although the anatomical relations of the right and left

carotid arteries are very different in the first part of their course, owing to the difference in their mode of origin, yet, in the cervical region, where the surgeon has to deal with them, these differences almost disappear. In the lower anterior triangle of the neck, the right common carotid is more superficial than the left, owing to its origin from the innominate trunk, which lies in front of the trachea, whilst the left carotid in this region has a closer relation to the œsophagus on its internal aspect, and at the very lowest part of the cervical region the thoracic duct corresponds to its external side. But in other respects, and higher up in the neck, their relative anatomy is very similar. The general course or position of the common carotids in the neck is indicated by a line drawn from the sterno-clavicular articulation to a point nearly midway between the angle of the lower jaw and mastoid process. The vessel divides into its great terminal branches, the external and internal carotids, at a point a little higher up than the upper margin of the thyroid cartilage. In the neck, the primitive carotid artery is inclosed in a common sheath, which contains the internal jugular vein and pneumo-gastric or vagus nerve. This common sheath rests upon the front of the cervical vertebræ, and more immediately upon the longus colli muscle, and, higher up, upon part of the rectus capitis anticus. Between the sheath and these muscles there is a quantity of fine connective tissue, which permits of free movement of the parts lying in front of the vertebræ. The cervical portion of the great sympathetic nerve also corresponds to the posterior aspect of the common sheath. On the mesial side of the sheath are the larynx and trachea, the lower part of the pharynx, and the œsophagus—the last-mentioned structure being more directly in relation to the left than to the right carotid. The superior and inferior laryngeal nerves pass behind the sheath in the course which they take towards their destination, and the inferior thyroid artery also crosses behind the sheath, and then corresponds to its inner aspect. Still more deeply, at the lower part of the neck, a chain of lymphatic glands lies to its inner side. On its outer or distal side

the sheath is in relation with the origin of the scalenus anticus. The common carotid artery, vagus nerve, and internal jugular vein, whilst included in the common sheath, lie each in a separate compartment; the septa between them being pretty strong and distinct, more especially as regards the compartment which contains the artery, so that we may expose the carotid without interfering with the vein and nerve. The artery lies in the inner compartment, *i.e.* nearest the mesial line of the body. The internal jugular vein lies most external, whilst the vagus lies between, and on a plane posterior to both. At the root of the neck, on the right side, the nerve is more exposed between the vein and artery, from the somewhat oblique upward course which the latter takes from its origin from the innominate. The coverings of the sheath vary at different parts of the neck. In the lower anterior triangle we have the skin, superficial fascia, and a few of the lower and inner fibres of the platysma; the layer of the deep fascia covering the sterno-mastoid and the inner head of that muscle, the sterno-hyoid and thyroid muscles, and the deeper layer of the cervical fascia from which the sheath is derived. Immediately above this point the sheath is crossed by the tendon and anterior belly of the omo-hyoid muscle, which passes from below, upwards and inwards, to reach the body of the hyoid bone, and forms the boundary between the superior and inferior carotid triangles of the neck. If we draw aside or divide the omo-hyoid, we see the lateral lobe of the thyroid gland, which generally overlaps the inner surface of the sheath. Above the point where it is crossed by the omo-hyoid muscle, the common sheath is only covered by the skin, platysma, and the superficial and deep fasciæ of the region. Branches from the superior thyroid artery to the sterno-mastoid muscle cross it obliquely from above, downwards and outwards. The descending branch from the ninth cranial nerve passes down in front of the sheath, and a little above the point where the omo-hyoid crosses the sheath. This nerve forms a loop-like junction or plexus with the anterior branch of the second cervical nerve, the branches from which pass to the tracheal muscles. In many cases, however, the

“descendens noni” is covered in by a layer of the sheath at the upper part of the neck.

The anastomoses to which we trust for re-establishing the circulation, after ligature of the common carotid, are so numerous, that we need have no anxiety on that point. We have—*1st*, The anastomosis between the superior thyroid branch of the artery which has been tied with the thyroid of the opposite side, and both anastomose freely with the inferior thyroids of the subclavian. *2d*, The lingual, on the side tied with that of the opposite. *3d*, The anastomosis between the facial arteries. *4th*, The anastomoses between the occipital arteries of opposite sides, and of the occipital with the vertebral. *5th*, The terminal branches of the external carotid—viz. the transverse facial, internal maxillary, and superficial temporal arteries—anastomose freely with the corresponding vessels of the opposite side; whilst, as regards the cerebral circulation, we have free anastomoses between the vertebral arteries and the internal carotids, through the circle of Willis within the cranium.

Operation.—The operative procedure adopted for tying the common carotid artery has been almost uniformly the same. An incision at least three inches long is made along the inner margin of the sterno-mastoid muscle, commencing higher or lower in the neck according as it is our intention to tie the vessel above or below the omo-hyoid. As the general course of the common carotid is indicated by a line drawn from the sterno-clavicular articulation to a point a little behind the angle of the lower jaw, whilst the anterior margin of the sterno-mastoid is indicated by a line from the sterno-clavicular articulation to the anterior margin of the mastoid process, it follows that as the vessel passes higher in the neck, the muscle diverges from the artery and corresponds rather to that part of the sheath containing the jugular vein, than to the compartment enclosing the carotid. Hence, in tying the artery above the omo-hyoid we should make our incision nearer the mesial line, more directly over the line of the vessel, and not follow closely the oblique line of the margin of the sterno-mastoid.

The patient should be placed with the shoulders moderately raised, the head supported by a pillow, the neck slightly stretched, and the face turned to the opposite shoulder, so as to make tense the sterno-mastoid. The surgeon should next compress the neck at the lower part, to make the superficial veins turgid, and thus ascertain their course in each individual case, so as to avoid them, or tie them previously to dividing them if necessary.

Having indicated this precaution as requisite in the living, I now make an incision in the line previously described, through the skin, platysma myoides, and superficial fascia. Commencing on a level with the upper part of the thyroid cartilage, I carry the incision downwards for three inches. When the skin and platysma are fully divided, my incision brings into view the deep fascia. That structure I next divide along the anterior edge of the sterno-mastoid, in the line and to the full extent of my superficial incision. This exposes the margin of the sterno-mastoid. A few light touches with the point of the knife divide any resisting connections, and with the ivory handle of the scalpel I now gently separate the loose cellular tissue, so as to enable me to draw the overlapping edge of muscle slightly aside by a blunt hook. You now observe a layer of the deep fascia covering in and binding down the omo-hyoid and other tracheal muscles and sheath of the vessels; the sheath being merely covered by this fascia at the upper part of the incision. I proceed to divide this fascia by raising a portion of it over the omo-hyoid, opening it with the point of the knife, and then slitting it open upwards and downwards. The muscular fibres of the omo-hyoid are now exposed and bare, and higher up the proper sheath of the vessels, more or less overlapped towards the mesial line by the lateral lobe of the thyroid body. This latter structure is drawn aside by a blunt hook. The sheath, now fully exposed, is opened carefully by raising a portion of it which lies immediately over the artery with a pair of dissecting forceps, and you will observe that I apply the edge of the knife horizontally, so as to cut out the portion raised without risk to the subjacent vessel. This manœuvre results in a rounded opening or hole in the sheath. I

clear the internal edge of this opening from the vessel, lay hold of it with a pair of artery forceps, so as to fix it, and give the forceps to an assistant to hold the edge gently, or simply let the forceps hang across the neck, and hold the margin aside by their own weight. I next seize the outer margin of the opening of the sheath with the dissecting forceps, and clear the vessel to a very small extent from its cellular connections, but thoroughly, so as to enable me to pass the armed aneurism needle round the vessel without any force. If I meet with any resistance, I withdraw the needle and clear the vessel a little more. When I see the point of the needle on the inner side of the carotid, I do not, you will notice, depress the handle so as to elevate the point from the wound, as that raises the vessel too much from its sheath, and is apt to tear and destroy its vascular connections. I merely keep the needle firm, and with the dissecting forceps seize the ligature and hold it, whilst I withdraw the needle. The point of the aneurism needle should always be passed from the outer side of the vessel, so as to avoid risk of injury to the jugular vein. If care be taken to open the sheath directly over the artery, and to keep the point and surface of the needle close to the coats of the vessel in passing round it, there is no risk of including the vagus nerve or injuring the vein. In my own experience in tying the carotid in the living I have felt the vein in the sheath, but have never seen it bulge over the artery. If, however, the sheath be opened so as to expose the vein, it will be more likely to overlap the artery and give trouble to the operator. The operation I have now demonstrated is that for ligature of the carotid above the omo-hyoid. (See Plate xxviii. Fig. 1.) When we require to tie the vessel lower down, we extend the incision downwards along the edge of the mastoid, and draw that muscle more fully aside than in the former operation; and now you will observe I divide the fascia which covers the omo-hyoid, and separate the connections of that muscle with the sterno-hyoid and sterno-thyroid. The omo-hyoid is then drawn upwards, and the sterno-thyroid drawn inwards. (Plate xxviii. Figs. 2 and 3.) The sheath is thus exposed, but much more deeply seated than

in the higher operation. In the living subject, when the neck is short and the omo-hyoid broad, it forms a considerable obstacle to dealing with the sheath and clearing the vessel ; and I have had occasion to divide a few of its fibres to gain room. Indeed, rather than tie the artery very low down, or have much difficulty or manipulation in the deep part of the dissection, I would strongly advise complete division of the anterior belly of the omo-hyoid, to expose the vessel easily and lessen the depth of the wound, and to render the operation less dangerous.

In one case in which I required to tie the left common carotid very low down, in a man with a short muscular neck, I found great difficulty in drawing aside the inner margin of the sterno-mastoid, which stood out in strong relief and deepened the wound. This was before the days of chloroform ; but still, were I now called on to operate so low down in the neck, I would make a small incision at a right angle with the cervical incision, so as to divide the skin and internal origin of the mastoid muscle, and reflect the flap thus formed, as in ligature of the innominate artery, so as to simplify the operative procedure.

M. Sedillot has proposed to reach the carotid artery by an incision between the sternal and clavicular attachments of the sterno-mastoid muscle. Such an incision, however, would correspond rather to the compartment of the sheath containing the jugular vein, than the artery, and the operation in the living would be more difficult, owing to the restricted space between the separated portions of the muscle ; and I therefore consider the ordinary method, with the modifications I have indicated in certain circumstances, as the best to be followed.

When the operation is concluded, the head should be bent slightly forwards to relax the parts and prevent tension of the deligated vessel. To fix the head in this position a circle of bandage round the head is connected with slips of bandage fastened to a broad circular bandage round the chest, and the patient is placed in bed with the head and shoulders raised. An opiate should be given, and some anodyne linctus, such as some emulsion containing small doses of hydrocyanic acid, or other

LIGATURE OF ARTERIES.

Plate XXVIII

Fig. 1



Fig. 2

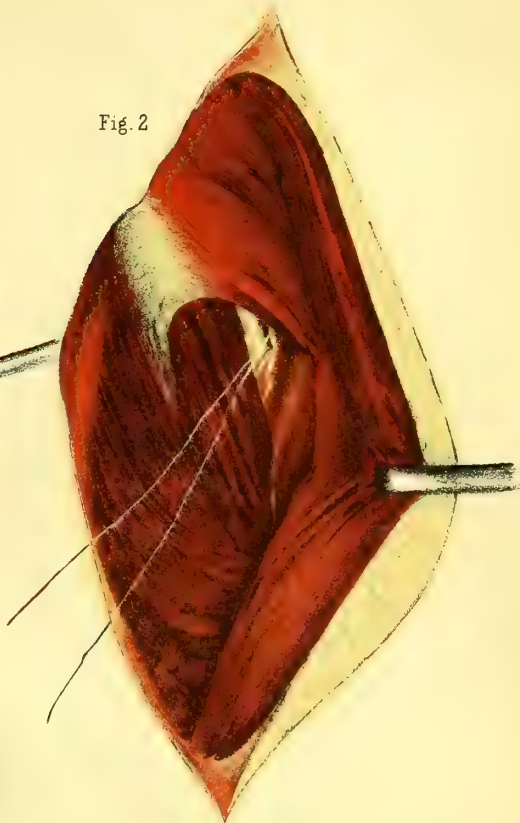


Fig. 3

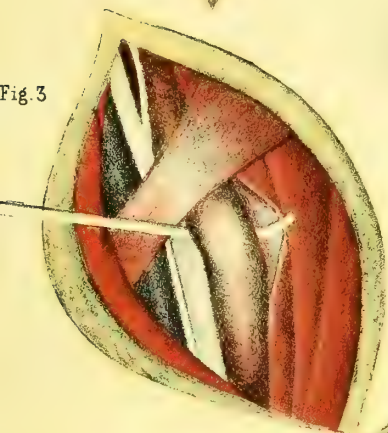
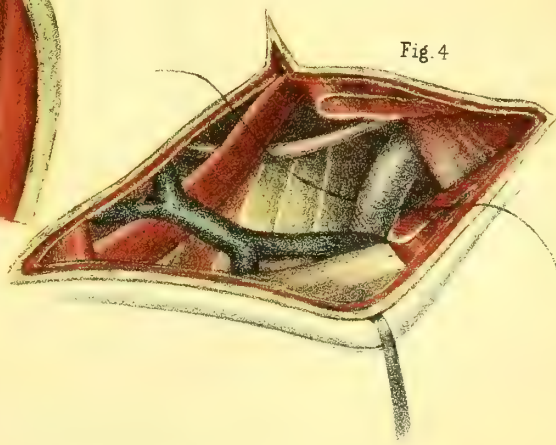


Fig. 4





sedative, to prevent or allay laryngeal irritation. When, however, irritation has led to symptoms of pulmonary congestion, I have seen marked benefit follow venesection, with relief of the urgent symptoms.

The diet should at first be nutrient, but non-stimulant, such as whites of eggs with milk, and farinaceous diet. White fish, and fowl or other animal food of a more stimulating nature, may be gradually given.

The first or internal portion of the SUBCLAVIAN ARTERY extends from the origin of the vessel to the inner margin of the anterior scalenus muscle. On the left side this part of the vessel, as it ascends from the thorax, is so situated as to be scarcely in the cervical region, and is consequently beyond the reach of surgical operation.

On the right side, owing to the manner in which it arises from the innominate artery, this part of the subclavian is placed in the neck, but is most unfavourably situated for the application of the ligature, whether we regard its complicated relations to important structures or the numerous branches given off within so short a space. From its origin till it reaches the edge of the scalenus anticus, the first part of the right subclavian is not more than an inch and a half in length, and in this space it gives off the internal mammary and vertebral arteries, and thyroid axis. These large collateral branches form a very great disturbing force on the distal side of the ligature, and so prevent the hæmostatic process taking place; while, on the proximal side, we have the force of the cardiac circulation through the innominate and right carotid arteries. The relations of the first part of the subclavian artery are also much more complicated than those of the innominate artery. This part of the subclavian is crossed in front almost immediately after its origin by the vagus nerve, whilst the recurrent laryngeal branch of that nerve curves round it, so that both these important nerves are in close contact with the vessel. Upon it and the innominate artery also lie the cardiac branches of the vagus. Immediately external to the vagus the

internal jugular vein crosses and covers the artery, whilst below the vessel is in relation to the commencement of the right vena innominata. This part of the subclavian is also in close contact with the pleura, and with the great vertebral vein. The latter is very troublesome in the operation, and cannot well be drawn aside, from its being fixed.

In most cases of subclavian aneurism, where any artery has been tied, the innominate has been the vessel chosen, for the reasons before given ; but when the first part of the subclavian is to be tied, nearly the same incisions are required as in the former operation :—one over the inner part of the clavicle, dividing both origins of the sterno-mastoid ; and another along the anterior margin of the sterno-mastoid, taking care to avoid the external jugular vein, which lies along the outer edge of the muscle. The artery is then exposed by careful dissection, and important structures held aside till the aneurism needle is passed below it and the ligature secured. It might be thought that the chief danger in the operation would be the sudden interruption of the supply of blood to the parts furnished by the subclavian ; but the real danger consists in the tendency which the free and forcible circulation around the deligated point has to disturb the subsequent hæmostatic process.

LECTURE LXXVI.

Ligature of the Middle and Third Portions of the Subclavian Artery—Ligature of the Axillary Artery in First, Second, and Third Portions—Ligature of the Radial Artery at Superior and Inferior Parts—Ligature of the Ulnar Artery.

ON reaching the anterior scalenus, the subclavian artery passes behind that muscle, and is directly covered by it until it emerges from behind its outer margin to gain the first rib, on the surface of which it continues to rest until, after passing from off the rib, it receives the name of axillary.

That portion which lies behind the scalenus is termed the middle portion of the subclavian, and is covered by the whole breadth of the anterior scalenus, and its course is crossed obliquely from above, downwards and inwards, by the phrenic nerve which rests upon the scalenus. The subclavian vein lies lower down towards the chest, resting on the anterior and inner part of the costal attachment of the scalenus, whilst more superficially this part of the vessel corresponds to the clavicular attachment of the sterno-mastoid muscle, platysma, and skin. In this part of its course the subclavian gives off two branches, or more generally a short common trunk dividing into two branches—the ascending deep cervical, and the subclavian intercostal. This middle portion, then, is very deeply seated ; its lower surface is in close relation to the pleura, whilst the phrenic nerve crosses its course in front. The third or outer part of the subclavian, commencing where the artery emerges from beneath the cover of the scalenus, is only covered by the skin, platysma, and superficial deep fasciæ of the neck ; but still, owing to the arch formed by the clavicle, the vessel lies very deep. As this is the part of the subclavian which is most frequently the subject of surgical operation, we require to consider its relations very carefully.

The external third of the subclavian artery is situated in what is termed anatomically the inferior external triangle of the neck, a space bounded internally by the outer margin of the sterno-mastoid, inferiorly by the clavicle, whilst the posterior belly of the omo-hyoid, passing obliquely upwards and forwards, forms the superior and outer boundary of the space. Superficially, the area of this triangular space is covered in by the skin, superficial fascia, platysma, and deep fascia; whilst under the platysma we find the external jugular passing down to join the subclavian vein, and placed generally close to the outer edge of the sterno-mastoid, though not unfrequently it lies nearly over the middle of the space. Its position, however, can always be readily ascertained by pressure on the lower part of the neck, so as to make the vein distend. On dividing the deep fascia which binds down the omo-hyoid, we come upon a quantity of loose cellular tissue, containing numerous venous branches, such as the transversalis colli and others, running towards the subclavian vein. These venous branches generally coalesce to form a large trunk before joining the subclavian, and the large vein formed by their junction lies almost in front of, and in close apposition to, the subclavian artery. We have now arrived at the deeper plane of the triangle, on a level with the artery and the parts in immediate relation with it. The subclavian artery may be described at this level as situated in a deeper triangle—the boundaries of which are, internally, the outer margin of the scalenus anticus; externally, the scalenus posticus, the convergence of the scaleni forming the apex of the triangle, whilst the base and inferior boundary is formed by the first rib, on which the vessel rests. Contained within the limits of this deep triangle we find the nerves forming the brachial plexus superiorly, and inferiorly the subclavian artery. Crossing the area of the space near its apex is the transversalis colli or its branches, the posterior scapular and ascending cervical; lower down, the vein already mentioned, lying in front of the subclavian artery, passing down to join the subclavian vein, which is situated lower down towards the chest, and barely resting on the tendon of the

scalenus anticus, so as to leave a small space in which the costal attachment of the muscle is seen between the vein and artery. The supra-scapular artery and vein lie in close relation to the posterior surface of the clavicle.

If we now consider the relation of parts in reference to guides to the third part of the subclavian, we find, first, that very generally the outer edge of the sterno-mastoid corresponds to the outer edge of the scalenus anticus, with sufficient accuracy to form a guide to the position of that muscle. Second, that the outer edge of the scalenus is in relation at its upper part with the nerves of the brachial plexus, and at its lower part with the subclavian artery which lies immediately behind it, close to its insertion into the first rib. That attachment of the scalenus anticus to the first rib is marked by a well-defined osseous prominence or tubercle.

If we pass the finger from above downwards along the outer margin of the scalenus muscle to its attachment, we are guided to the tubercle on the first rib, and when the point of the finger touches the tubercle, the pulp of the finger must rest in contact with the subclavian artery, which lies in a shallow groove on the rib immediately behind and external to the tubercle. Thus we have a series of guides leading us from the surface to a fixed point in close relation to the artery, if it be in the normal position.

The position and relations of the middle and external portions of the subclavian arteries are remarkably constant, for although cases have been met with in which the artery ascended high in the neck, and then passed downwards and much further back than usual, or others in which the vessel perforated the anterior scalenus, and although there are also instances of the vein as well as the artery lying posterior to the scalenus anticus, or of the artery passing in front of the scalenus anticus, so as to be in close contact with the vein, yet such irregularities are very rare. In my own experience as an anatomist, out of many hundred bodies dissected in the practical rooms, where any abnormal distributions of the blood-vessels were carefully watched for, I have

only seen two instances of irregularity in the third portion of the subclavian, in both of which the artery passed in front of the scalenus, so as to be in apposition to the subclavian vein, and in both cases the irregularity was on the right side. The third part of the subclavian is usually described as not giving off any branches ; but I believe it is almost as common to find the posterior scapular artery coming off from the subclavian close to the outer edge of the scalenus, as to find it arising from a common trunk with the ascending cervical from the thyroid axis, which is generally stated to be its usual mode of origin.

The anastomoses to which we chiefly trust for restoring the circulation after deligation of the external third of the subclavian are—1st, The supra-scapular, with the dorsal branches of the subscapular artery in the substance of the supra- and infra-spinatus and teres minor muscles. 2^d, The posterior scapular artery, with branches from the subscapular along the inferior costa and base of the scapula, and in the substance of the subscapular muscle. 3^d, Minute perforating branches from the internal mammary and intercostal arteries, inosculating with thoracic branches of the acromio-thoracic artery and other thoracic branches given off by the axillary. But, besides these more evident and direct anastomoses, the determination of blood on the collateral circulation which follows the obstruction of the subclavian artery brings into play vascular communications throughout all the surrounding tissues.

As ligature of the middle part of the subclavian has never been performed except as an extension of operations originally undertaken with the view of tying the external third, in which, owing to disease of that part of the vessel, it was found necessary to divide the scalenus to reach a healthy part of the artery, it is unnecessary to describe it as a special operation. But to consider the further procedure in such cases in connection with the operation for tying the third portion of the artery :—

The external third of the subclavian may be reached so as to apply a ligature, by means of a single incision parallel to and about eight lines above the clavicle, extending from the anterior

margin of the trapezius muscle to a point a few lines internal to the outer margin of the sterno-mastoid. The more important parts of the operation will, however, be much facilitated by making another incision about an inch and a half in length along the outer edge of the sterno-mastoid, so as to join the former incision nearly at a right angle. This method enables us, by dissecting or merely drawing back the angular flap marked out at the internal part of the wound, to expose more fully the parts immediately in relation to the vessels, so as to deal more readily with the artery, or to modify the operation, if necessary, by extending our incision inwards. There is no use in dissecting deeply at the outer part of the supra-clavicular incision, as we gain no room by doing so, and it is liable to lead us away from the subclavian artery and endanger the supra-scapular vessels. The skin, superficial fascia, and platysma myoides, should be divided by the first incision in the line indicated, care being taken to cut lightly through the textures over the course of the external jugular vein, so as to avoid wounding that vessel, which should be drawn aside, if necessary, by a blunt hook. The next step in the operation consists in dividing the deep fascia at the middle and inner part of the wound. In doing this there should be no dissection upwards or downwards; the fascia should be divided in the line of the incision directly from the surface towards the deeply-seated parts. When this is effected the angular flap of the textures can be drawn upwards and backwards, not forcibly, but merely held aside. At this stage the posterior belly of the omo-hyoid generally comes into view, and has by some been recommended as a guide; but it is not a safe guide to the artery, since it merely marks the depth or plane at which we have arrived. When the deep fascia is divided, the operator should pass his finger close to the outer edge of the sterno-mastoid muscle, directly backwards, to try if he can feel the outer margin of the anterior scalenus, or perhaps touch the artery itself. In general, however, the outline of the scalenus and the position of the vessel are rendered indistinct by a quantity of areolar tissue and lymphatic glands being

interposed, and the operator requires to break through this layer with his finger, or the cautious use of the point of the knife, to clear the scalenus more fully ; he then glides the forefinger of his left hand from above downwards along the outer margin of the scalenus anticus, till the point of his finger touches the tubercle on the first rib, into which the muscle is inserted ; immediately above and behind this the subclavian is felt. By attending to this rule, the operator will avoid the risk of mistaking the large nerve which passes from under the edge of the scalenus immediately above the subclavian for that vessel. The next and most important step is to clear the vessel for passing the armed aneurism needle. In doing this we must keep in view the position of the venous branches crossing the course of the artery in front to join the subclavian vein, whilst higher up and deeper the pleura is in close relation to the deep surface of the vessel, and may be wounded in passing the needle. The former of these dangers is best avoided by the mode of incision I have recommended, which enables the operator to see the deep part of the wound, and, by using the point of finger and nail, gently to separate any loose tissue and push aside the veins before using the point of the knife, to clear the artery for ligature. The second danger—wound of the pleura—is best avoided by passing the needle under that part of the subclavian which rests upon the first rib, not higher up ; and this rule is also advantageous, should the posterior scapular artery arise, as it often does, from the third part of the subclavian close to the edge of the scalenus. The aneurism needle for this operation should be short in the point, and have a double curve to play over the clavicle, so as to allow the point to appear round the artery without elevating the vessel and unduly separating its connections. In accordance with the general rule, the point of the needle should be passed from the position of the subclavian vein upwards and outwards ; but in many cases it is difficult to effect this, owing to elevation of the shoulder raising the clavicle so as greatly to deepen the subclavian space. In such cases the point of the finger may be made to guard the vein whilst the needle is passed from above downwards.

Should the third portion of the subclavian be found in a doubtful condition for the safe application of a ligature, the incisions must be extended so as to expose the middle portion. For this purpose the incision is carried through the clavicular attachment of the sterno-mastoid and superimposed tissues. This procedure, added to the former incisions, exposes the scalenus anticus, with the phrenic nerve crossing it obliquely from above downwards and inwards, and lower down, and more internal, the confluence of the subclavian and internal jugular veins. Two important arterial branches, the transversalis colli and supra-scapular, cross the scalenus more superficially than the parts mentioned, and require to be avoided in dissecting through the cellular tissue lying between the sterno-mastoid and the more deeply seated parts. Even in tying the third portion of the subclavian I have seen one of these vessels wounded, and give rise to serious embarrassment to the surgeon and danger to the patient. And we must also remember that these are two of the most directly and important anastomosing branches for re-establishing the circulation in the upper extremity after deligation of the subclavian. The special points of danger, however, in this extension of our incision to expose the part of the artery covered by the scalenus, is the risk of injuring the phrenic nerve lying upon the muscle to be divided, and injury of the pleura, which is here in close proximity to the vessel to be tied. The former danger is met by drawing the nerve gently aside by means of a narrow copper spatula, and then carefully dividing the scalenus, so as to expose the subclavian, whilst the wound of the pleura is guarded against by keeping the point and concave surface of the aneurism needle in close contact with the coats of the artery in passing round it.

When all oozing of venous blood has ceased, the wound is closed by points of suture, and the patient placed in bed, with the arm supported but not much bent. The patient should be laid upon the side operated on, so that serous discharge or venous oozing, if there be any, may escape by the outer angle of the wound. One of the secondary risks of ligature of the subclavian, apart from the risk of secondary hæmorrhage, is the formation of

pus at the deep part of the wound from the accumulation of discharges which have lodged there, and as there is great difficulty in placing the patient so as to obtain a dependent aperture of escape, the pus is apt to burrow towards the pleura, and even ulcerate into the pleural cavity. To obviate this risk, as well as that of secondary hæmorrhage, there should be the least possible disturbance or fingering of parts during the operation ; all oozing of blood, however slight, should be arrested by cold or some other plan before the wound is closed, and attention given that no accumulation be allowed to take place.

LIGATURE OF THE AXILLARY ARTERY used to be performed for axillary aneurism, but the operation has now been given up. I should only perform it in Brasdor's operation for tying the artery on the distal side of the aneurism, in the case of subclavian aneurism, or as a preliminary to amputation of the arm for such ; I should be inclined to tie the upper part of the axillary, so as to prevent bleeding from the enlarged muscular branches, and also because it would avoid having a great number of collateral branches coming off between the aneurism and the ligature. The operation is a much more difficult one than tying the third part of the subclavian artery. Some authorities recommend cutting down between the two portions of the pectoral muscle, and cutting through the coraco-clavicular fascia, but in doing this we come upon the vein and not the artery ; and secondly, we have a very constricted and narrow opening with a very deep wound. Others, again, advise to cut between the clavicular fibres of the deltoid and the clavicular fibres of the pectoralis major, but this is also objectionable. The best plan is to cut across the fibres of the pectoralis major and some fibres of the deltoid, so as fully to expose the deeper parts, and then through the coraco-clavicular fascia. Care must be taken not to wound the axillary vein, which is superficial and internal to the artery. The axillary nerves lie to the outside of the artery, and are not much in the way. This operation, however, merely enables us to get at the vessel just at its commencement, and nearly the

same point can be reached much more readily by the operation for ligature of the third part of the subclavian, without approaching so nearly the origin of the large acromio-thoracic branch.

The middle, or second portion, of the axillary artery is never tied, in cases of aneurism, from the number of collateral branches coming off from it. When wounded it may require ligature, which must be effected by enlarging the external wound.

The third portion of the axillary artery may be tied quite as easily as the brachial artery. In this case, our best guide is the inner edge of the coraco-brachialis muscle. If we trust to the feeling of pulsation in the artery as our guide to its position, we are very apt to be misled. After dividing the skin and fascia, the first thing we should look for is the margin or edge of the coraco-brachialis. Immediately internal to it the median and internal cutaneous nerves come into view, and behind and between them is the artery. The nerves are separated slightly, the arm being relaxed, and the needle is then easily passed round the artery.*

The BRACHIAL ARTERY may require to be tied in cases of circumscribed false aneurism, or circumscribed varicose aneurism ; and it has in such cases been tied in the middle of the arm with success ; but still I think the best plan of treating a false aneurism is to cut into it, and tie the vessel above and below, so as to prevent all retrograde circulation. The cases in which the brachial artery requires to be tied are those in which either the brachial itself or the palmar arch has been wounded. In the latter case, the general principle of securing the vessel at the wounded point in the first instance should be followed out ; but if hæmorrhage result after doing this, and if the parts be in such a state that we cannot apply pressure directly on them, then we must tie either the radial and ulnar arteries, or the brachial, and apply some moderate compression on the wounded point. In wounds of the palmar arch we should enlarge the opening in the skin and fascia at first, and apply direct compression on the arch, with a bandage and pad of lint along the course of the

* See Clinical Cases, page 594.

brachial, so as to command the circulation. In most cases these means will succeed ; but when they prove inefficient, or when the coats of the artery slough, then we must tie the brachial in the middle of the arm, which is safer than tying both radial and ulnar arteries, from the free anastomoses of these vessels, and we must also apply a moderate amount of compression on the wounded point.

Operation.—The brachial artery is very easily reached, and can generally be felt in the living subject ; but we should not trust to the feeling of pulsation only, as we are apt to be misled. The best guide to the position of the artery is the inner margin of the biceps, the arm being extended. The median nerve passes obliquely from without inwards and downwards, crossing the vessels, so that it lies upon the artery about the middle of the arm. It must be gently drawn aside, the vessel cleared from the venæ comites, and the needle then passed below the artery. When we cut down on the artery at the middle of the arm, if we find a large vessel, without seeing the nerve, it is probable that the artery has divided into its two terminal branches, higher up than usual, and the other branch should be looked for in its normal relation to the median nerve.

The brachial artery may require to be tied at the bend of the elbow in cases of false aneurism. A tourniquet is applied at the upper part of the arm, so as to prevent all bleeding ; and an incision is made into the sac of the aneurism, and its contents turned out, and the vessel tied above and below the wounded point—as already described at page 559 (Plate xxv. Figs. 1 and 2).

The ARTERIES OF THE FOREARM seldom require to be tied except for the immediate or secondary effects of wounds. In such cases the wound should always form part of our incision, as, otherwise, the wounded part of the vessel may not be reached except by unnecessary dissection. But whilst this will modify the procedure for ligature of the vessels in different cases, I think it right to indicate some general rules for the performance of ligature of the radial and ulnar arteries.

To perform the ligature of the RADIAL ARTERY above the middle of the forearm, the limb being extended and resting upon its dorsal surface, the surgeon, placed to the outside, makes an incision at least two inches in length, and parallel with the internal edge of the supinator radii longus muscle. In order to find the edge of that muscle, it is sufficient to apply the fingers of the right hand upon the radial artery, as if to feel the pulse, and trace it towards the bend of the arm by following the furrow, which is bounded externally by the supinator radii longus, and internally by the pronator radii teres and palmaris longus muscles.

In this manner the intermuscular space which lodges the vessel is easily found. If the incision, however, is not made perfectly to correspond with this line, it will not be of much consequence ; to remedy this fault it is sufficient to divide a few muscular fibres to arrive at the artery, which is always found in the first intermuscular space we arrive at in tracing from the external to the internal side of the forearm. The mobility of the skin upon the aponeurosis renders the examination of this space very easy. The skin alone having been cut, the surgeon searches, as we have said above, for the internal edge of the supinator radii longus muscle, and dividing the aponeurosis parallel with that muscle, and slightly raising it, perceives the vessel placed immediately below. But before proceeding to insulate, in order to tie the artery, he must open the aponeurotic covering of the supinator radii longus muscle. This layer divided, the operation is easily terminated.

At the inferior part of the forearm the muscles which we have seen to surround, by their fleshy bodies, the upper portion of the radial artery, being only represented by their respective tendons, a large space is left between them, so that nothing can be easier than the ligature of the artery in this region. This artery is accompanied, as in its superior parts, by two veins, one internal and the other external to it, and covered by the aponeurosis and the skin.

To perform this operation, an incision corresponding with the

middle of the space which separates the tendons of the supinator radii longus and the flexor carpi radialis muscles must be made to divide the skin, and the aponeurosis must be divided to the same extent as the skin. This done, the artery, with its accompanying veins, is seen ; the insulation must be carefully effected, so as not to wound the veins, and the ligature applied. It may be mentioned, however, that the rupture of a single vein, or its ligature, if it be small, does not occasion any real danger.

In order to tie the ULNAR ARTERY at its upper part, the forearm must be extended and laid upon its dorsal surface. The surgeon, placed either to the inner or outer side of the limb, searches for the tendon of the flexor carpi ulnaris, which is readily known at its inferior part by feeling for the pisiform bone to which it is attached. This done, he must trace from below upward the furrow which separates the tendon from that of the flexor digitorum sublimis, and thus proceeding towards the internal condyle of the humerus, the direction is indicated in which the incision must be made. The surgeon, after having determined the edge of the flexor carpi ulnaris, makes an incision of the skin with the bistoury, parallel to that edge ; he then searches for the first intermuscular space which can be found proceeding from the ulnar to the radial side of the arm. If the skin be very movable, this is easily distinguished, so that, if the first incision be badly directed, it can be corrected by means of the mobility of the skin. We could not, however, avail ourselves of this resource had the skin, aponeurosis, and a certain portion of the muscular fibre, been cut at the same time.

Having found the intermuscular line which is formed by the contact of the flexor carpi ulnaris, and of the flexor digitorum sublimis, the aponeurosis which unites them must be divided, and those muscles forcibly separated from each other. In order to facilitate the opening of the wound, it is recommended that the hand be slightly flexed upon the forearm, and the forearm upon the arm. In following the external surface of the flexor carpi ulnaris from within outward, we see upon the same plane first the ulnar nerve, the internal vein, and then the artery with

the other vein to its outside. At the superior angle of the wound the nerve is separated from these vessels by a space which diminishes towards the inferior angle, until they become in immediate contact. These vessels having been exposed, the artery must be insulated and tied.

Ligature of the ulnar artery at the inferior part of the forearm becomes much easier. The two muscles, which, being in apposition superiorly, cover the artery and its accompanying veins, are in this region separated from each other for the space of four or five lines, so that it is extremely easy to arrive at the artery. To accomplish this an incision of the skin must be made parallel to the tendon of the flexor carpi ulnaris, but two or three lines external to it ; the position of the pisiform bone, into which it is inserted, forms a sure guide to the tendon. Having divided the skin, the last-named tendon must be found, and the aponeurosis divided to the same extent as the incision of the skin. The opening having been made, the tendon of the flexor carpi ulnaris, the nerve, and then the vessels, are exposed to view ; the artery is placed between its two veins, it is easily insulated, and its ligature accomplished.

LECTURE LXXVII.

Surgical Anatomy of the Iliac Arteries—Steps of the Operation for tying them
—Modes in which the Circulation is subsequently re-established—Direct
Ligature of the Iliac Arteries for Aneurism.

THE abdominal aorta, on reaching the lower part of the lumbar vertebræ, divides into its terminal branches, the two common iliac arteries, and its more direct continuation, the small artery known as the middle sacral. Its two great lateral branches, the common iliac arteries, descend obliquely outwards and somewhat forwards, diverging until they arrive in front of the sacro-iliac synchondrosis, at which point each common iliac again subdivides into the internal iliac or hypogastric artery and the external iliac.

The internal iliac artery passes abruptly downwards from the point of division in front of the sacro-iliac synchondrosis, and, on arriving at the level of the ischiatic notch, subdivides into numerous branches to the various pelvic viscera, and others which pass through the obturator foramen and ischiatic notch to be distributed outside the pelvis. The external iliac artery, from its place of origin, passes downwards and slightly outwards until it reaches a point nearly midway between the anterior superior spine of the ilium and the body of the pubis corresponding to the ilio-pectineal eminence; it then passes beneath Poupart's ligament, and receives the name of common femoral. The relations of the arteries whose general course I have indicated may be stated as follows:—Each common iliac is about $2\frac{1}{2}$ inches long, and, in its descent, rests on the lateral aspect of the bodies of the inferior lumbar vertebræ, and is somewhat in relation laterally to the inner part of the psoas muscle, to which it approaches more closely at its bifurcation. On the right side the common

iliac trunk rests, in its lower half, upon the junction of the right and left common iliac veins, where they are about to form the inferior vena cava, or, more properly speaking, rests on the commencement of the cava. On the left side the common iliac vein lies completely internal to the corresponding artery. In front these vessels are covered by a layer of the peritoneum, very loosely connected with them and easily pushed aside. Still more in front we have the abdominal viscera and inferior mesenteric artery, and the anterior abdominal parietes, which have a variable relation to the vessels, in regard to distance, according to the development or distension of the abdomen and the state of the viscera. The ureter occasionally crosses the common iliac trunk ; more generally, however, this duct crosses obliquely immediately below the bifurcation, or just at that point. In either case the ureter is very loosely connected with the parts over which it passes, and when the peritoneum is pushed inwards from off the surface of the vessels the duct follows the peritoneum. The internal iliac artery in its course rests posteriorly on the nerve connecting the lumbar and sacral plexus, and on the nerves forming the latter plexus as they pass outward. The corresponding veins lie to the inner side of the artery, towards the upper part, where the surgeon should apply his ligature, for the internal iliac trunk is very short and variable in its length. The numerous veins which coalesce to form the internal vein have also very variable relations, some passing behind and some crossing it in front, and require to be carefully avoided in clearing the artery for ligature. The ureter lies in front, attached to the posterior surface of the layer of peritoneum which passes from the lumbar region and iliac fossa, and covers the fore part of the internal iliac artery.

The external iliac artery rests throughout its whole course upon the inner aspect of the psoas muscle, and more immediately upon the aponeurotic fascia, covering the muscles of the iliac fossa. The connective tissue here is very fine and loose, so that the vessel is easily separated from its posterior connections. The external iliac vein lies in close contact with the internal side of

the artery, and in front a branch of the ilio-lumbar nerve lies upon it; further removed, and gradually passing towards the parietes, the spermatic artery and veins also pass down in front. In some cases, lymphatic glands lie in close relation to the vein at the lower part. The fold of peritoneum reflected from the anterior abdominal parietes upon the iliac fossa, covers the fore-part of the vessels, but at a short distance above Poupart's ligament, corresponding to the point of reflection, the peritoneum may be said to be separated by an interval from the artery and vein; and throughout the whole of the iliac fossa, and immediately above Poupart's ligament, the peritoneum is so loosely connected as to be easily separable from the vessels; whilst higher up, in the lateral region of the anterior abdominal parietes, the membrane is very closely connected with the fascia transversalis, and attempts to separate it from the parietes there would almost certainly be attended with laceration or puncture. On arriving close to Poupart's ligament, the external iliac gives off two branches, the deep epigastric and circumflex ilii arteries. The former courses obliquely upwards and inwards, the latter outwards in the direction of the spine of the ilium. The vas deferens, as it passes from without inwards, crosses the course of the external iliac vessels, more especially that of the vein, and, together with spermatic vessels forming the spermatic cord, lies in pretty close relation to the anterior aspect of the vessels near the lowest part of their course. Lastly, in front we have the intestines projecting into the peritoneal sac and the anterior abdominal parietes, as in the case of the other iliac arteries. In speaking of the general course of the external iliac artery, I have described its normal position on the anterior and inner aspect of the psoas throughout its whole length; but in old persons, or in cases in which an aneurism or other cause of obstruction to its circulation is present, the artery, owing to the feeble cellular connections which it has with the fascia on which it rests, forms numerous flexures, or one or two large curves, so that a large part of the vessel often dips into the true pelvis before it ascends again to gain the pubis. This need give rise to little or no difficulty in

operating for ligature of the vessel, because at its lower part it is always found on the pubis ; so that, by tracing it from that point upwards, or from its bifurcation downwards, its position in any case can be readily ascertained. But it is well to recollect how easily it is displaced, in relation to diagnosis of iliac aneurism, and in deciding whether the external or common iliac artery should be tied, for in some cases of aneurism low down on the external iliac, the tumour displaces the upper part of the artery, curving it on itself, and thus might mislead us as to the extent of healthy artery between the aneurism and the common iliac.

Operation.—From the anatomical disposition of the parts as described, it results, that to expose and tie any of the iliac arteries, the skin, superficial fascia, the aponeurosis of the external oblique and the internal oblique and transversalis muscles, together with the transversalis fascia, must be divided, whilst the peritoneum must be carefully separated from the iliac fossa, and pushed aside.

In performing the operation, the patient should be laid upon his back, the pelvis a little inclined towards the healthy side, so that the floating intestines may fall into the pelvis and cause less projection of the peritoneum into the wound. The operator, having ascertained the position of the spine of the pubis, commences his incision about two inches external to that point, and about eight lines above the crural arch, and carries it obliquely upwards through the skin and superficial fascia for about three or four inches, so that it shall terminate above, about ten lines internal to the anterior superior spinous process. It is evident that by this line of incision we cannot come directly upon the artery, but then we weaken the abdominal parietes less than by any other line of incision, and we reach a part where we can most readily push aside the peritoneum without risk. Any branches of arteries or veins which bleed should be tied, and then the aponeurosis of the external oblique muscle divided to the same extent as the incision of the integuments. The fibres of the internal oblique and transversalis muscles are next carefully

divided, to the extent of two inches, at the lower outer part of the wound. The fascia transversalis is thus exposed, and must be divided with great caution lest we wound the peritoneum. Perhaps the best method of doing this is to raise a small portion in the dissecting forceps, and apply the edge of the knife, held horizontally, so as to cut out a small portion. This enables the surgeon gently to separate the edges of the opening in the fascia, and enlarge the opening with a probe-pointed bistoury, the edge of the bistoury being directed outwards. By the small opening thus made, the operator enters his forefinger and carefully separates the peritoneum from the transversalis fascia muscle, in the line of his incision, and then slits up the internal oblique and transversalis muscles to such an extent as may be necessary to enable him to reach the vessel. He next pushes the peritoneum aside and inwards from the iliac fossa, so as to expose the artery. An assistant, whose hands have been previously dipped in warm water, holds aside the sac of the peritoneum and contained viscera, so as to keep them out of the way of the operator, but this must be done with great care. If necessary, the outer margin of the wound may be held aside by a curved metallic spatula, but in general the vessels are readily seen. The fine cellular sheath should be opened over the fore part of the artery, and the circumference of the vessel cleared, so far as is required to pass the armed aneurism needle. The point of the needle should be passed from within outwards, so as to avoid injuring the vein. When the point appears at the outer side of the artery, the ligature is seized with the dissecting forceps, the aneurism needle withdrawn, and the vessel tied. Before closing the wound all clots should be removed, and any bleeding points secured. In closing the incision, the sutures should be placed deeply, to prevent the risk of protrusion, and to obtain union of the deep as well as of the superficial parts of the incision, and thus obviate weakness of the abdominal parietes. In passing the sutures with this view care must of course be taken to avoid puncture of the peritoneum with the needle. When the operation is completed, a large flat compress of lint is placed over

the wound, and kept in position by broad strips of adhesive plaster, so as to support the abdominal wall in the vicinity of the incision. When removed to bed, the patient should be placed on the sound side, to remove, as far as possible, all pressure from the weakened part, and an opiate given to procure rest and diminish the peristaltic movements of the intestines.

The operative procedure for reaching either the internal or common iliac arteries, is, up to a certain point, precisely similar to that just described; but when the surgeon has to some extent separated the peritoneum from the iliac fossa, he continues to separate it further up from the interior of the transversalis muscle and fascia, pushing it gently inwards, and then, with a probe-pointed bistoury introduced flat on his finger, he turns the edge upwards and extends the incision to the degree required to enable him to reach the vessel which he wishes to tie. He must, however, remember that the closer attachment of the parietal peritoneum, and the greater bulging of that membrane high up in the abdomen, render it more liable to injury, and he must also keep in mind his proximity to the ureter and spermatic vessels.

The method of tying the external iliac by a nearly transverse incision, about six or eight lines above Poupart's ligament, as practised by Sir Astley Cooper, enables the surgeon to reach the vessel easily enough at its lower part in the case of a femoral aneurism which does not bulge upwards. But the vessel is exposed too near its collateral branches, the epigastric and circumflex ilii, and the spermatic cord is in greater danger. The principal objection, however, is, that we cannot tie the vessel higher up, should that be found necessary, without having recourse to a new line of incision such as that which I have described, so that the oblique ascending incision, Abernethy's method as it is sometimes termed, is that generally, and I think deservedly, preferred.

The arterial anastomoses which maintain and ultimately re-establish the circulation beyond the point of deligation in the case of ligature of the external iliac artery, are very numerous,

for, as I have already shown, every minute twig enlarges at first. But the larger and more direct inosculations, are—1. The internal mammary from above, with the deep epigastric from below, the deligated part. 2. The ilio-lumbar and lumbar branches of the aorta, with the deep circumflex ilii of the external iliac. 3. The extra-pelvic branches of the internal iliac, with branches of the femoral—as, the scrotal branches of the deep pudic, with those of the superficial or inguino-pudic branch of the common femoral, and the gluteal ischiatic and obturator, with the branches of the internal and external circumflex and perforating arteries from the deep femoral.

When the common or internal iliac arteries have been tied, the free communications between the branches of the two internal iliaes, and of both with the middle sacral, together with the anastomoses just mentioned, speedily re-establish the circulation below the ligature, and the maintenance of the distal circulation is amply provided for.

When speaking of inguinal aneurisms, I referred to the revival of the old operation for aneurism, by opening the sac, turning out the contents, and then tying the vessel on either side of the sac. It is scarcely possible to lay down rules for the steps of such operations. The plan hitherto adopted has been to command the circulation through the abdominal aorta, by means of the abdominal tourniquet, and then to make a limited incision through the anterior parietes into the sac, to enable the operator to introduce his forefinger and break up the adherent coagula; then rapidly to enlarge this opening upwards and downwards, and turn out the coagula, and so expose the interior of the sac, and recognise the opening of the artery into it above and below, and clear the vessel and tie it at these points.

From what I have seen of such operations, it always appeared to me that very great difficulty occurred in recognising the orifices of the artery in the sac, and this is what we might expect from the way in which true aneurism, either saccular or fusiform, arises. Again, as I have pointed out when speaking

of the loose connections of the external iliac artery, an aneurism of the lower part of that vessel, by enlarging, may push up or aside the upper part of the vessel, and lead the surgeon to suppose it necessary to tie the common iliac. I should, if performing such an operation, make my incisions through the abdominal parietes where these were not adherent to the sac, by dividing them upwards and outwards towards the ilium and flank. Then, passing the finger gently downwards between the sac and the parietes, as far as that could be done without force, I should divide the abdominal wall in that direction. The peritoneum in such cases is usually pushed upwards and inwards by the tumour, and is so far removed from injury. Having enlarged the opening of the abdominal wall as far as could be done without injury to the sac, I should then feel with my finger for the artery higher up, so that an assistant might command it by direct compression, or I should clear it as closely down to the sac as possible, and place a ligature under it, and entrust it to the assistant. Then, returning to the lower part of the incision, I should by careful dissection divide the crural arch and fascia lata in the groin below the tumour, to command the circulation from below, and if possible trace and expose the artery close up to the sac, and let an assistant compress it directly. All being thus prepared, I should make a small incision into the sac, break up the coagula, enlarge the opening, and turn them out. The circulation being commanded both above and below the aneurism, I should then tie the upper ligature which had been placed under the vessel, and entrusted to an assistant at the earlier stage of the operation. If the lower portion of the artery admitted of ligature above the origin of the epigastric and circumflex ilii, I should tie it there, but if not, then I should clear the common femoral where it had been exposed, and pass a ligature below it. Any coagula which remain, or portions of the sac which can be removed without risk to the peritoneum, should be cut away, so as to diminish the risk of extensive suppuration, and the wound then closed.



LECTURE LXXVIII.

Ligature of the Femoral Artery : in Lower Part of Scarpa's Triangle ; in Hunter's Canal—Anastomoses by which the Circulation is restored—Ligature of the Anterior Tibial Artery : of the Posterior Tibial Artery.

FROM the point where the external iliac artery emerges from below Poupart's ligament into the region of the thigh, until it enters the popliteal space, by passing through the opening in the tendon of the adductor magnus, the vessel receives the name of femoral. The general course of the FEMORAL ARTERY, if we include the commencement of the popliteal, is indicated by a prolonged and gently spiral line, which, in relation to the femur, descends from without inwards and backwards, then more directly downwards, and lastly, outwards and backwards, winding round so as to gain the posterior aspect of the femur in the popliteal space. The common femoral artery, the direct continuation of the external iliac, is always a very short trunk, not exceeding an inch and a half in length ; and, after passing from off the pubis, descends superficially, being merely covered by the integuments, superficial fascia, and the iliac portion of the fascia lata, and a variable quantity of fat and lymphatic glands lying on the fascia over the vessel. In this part of its course the vessel rests upon the lower part of the psoas, having the mass of the iliacus muscle, which is here united with the psoas, in relation to its outer side. The anterior crural nerve is in this region deeply seated between the iliacus and psoas muscles, but soon becomes superficial, and lies about quarter of an inch, or rather more, to the outer side of the artery. The common femoral vein lies close to the inner side of the artery, and rests on the pectineus, a quantity of cellular tissue intervening. The common femoral gives off superficial branches—the superficial epigastric, superficial circumflex ilii, and superficial pudic. It then sends off the great pro-

funda or deep femoral, which gives off numerous branches to the muscles and other textures of the thigh. The femoral artery continues to descend in the course already described, till it reaches the popliteal space. As the femoral artery descends in the thigh, it gradually passes more deeply, and its relations become more complicated; the vein, which above lies to its inner side, gradually comes to be placed behind it, so that the artery rests upon the vein. Both these vessels, together with the great saphenus branch from the anterior crural nerve, are inclosed in a common sheath, which lies in a canal bounded internally by the adductors, and externally by the vastus internus, where these muscles converge near their attachments to the femur. A layer of dense fascia, stretching from the vastus to the adductor muscles, passes in front of the vessels and closes the canal anteriorly. This fascia becomes aponeurotic towards the middle and lower parts of the thigh, and the canal, for two or three inches above the point where the vessels pass out of it into the popliteal space, is very narrow and contracted. In the middle and lower third of Scarpa's triangle, the femoral continues to be covered only by the skin and fasciæ; but gradually the sartorius muscle, which descends obliquely inwards from the superior spine of the ilium, comes into relation with the vessel lying, at first, close to its outer side, on a plane superficial to it; next, slightly overlapping; and at last lying upon and covering the artery throughout the remainder of its course in the femoral region. The point of election for tying the femoral is at the apex of Scarpa's triangle, just where the sartorius begins to overlap the vessels, and hence the inner edge of this muscle forms our guide to reach the artery at this point; whilst, if we require to tie it lower down in Hunter's canal, the outer edge of the sartorius again serves as our guide to secure it. Under the fascia, beneath the sartorius, and in front of the sheath, there are sometimes a quantity of fat, and some nervous filaments from the anterior crural, which cross the vessels obliquely. From the point where the femoral artery gives off the profunda, with

the exception of a few small muscular twigs, no large collateral branch arises from it, until, at its lowest part; just before it passes through the adductor into the popliteal space it gives origin to the *anastomotica magna*.

*Operation.**—I have already said that the point of election for tying the femoral artery is towards the lower part of Scarpa's triangle, immediately above its apex, where the sartorius and adductor longus muscles approach each other. Here the sheath of the vessels is comparatively superficial, and the relative position of the sartorius gives us an excellent guide to the artery. The surgeon having ascertained the course of the sartorius, and also the position of the saphena vein and the superficial veins which sometimes join that vessel in this region, should make an incision about three inches long, beginning an inch or so below the apex of Scarpa's triangle, and continuing it upwards to the requisite extent along the course of the artery. This line will correspond to the inner margin of the sartorius. Higher up the muscle lies more obliquely outwards, less in relation with the artery. In operating on the right limb, the surgeon cuts from above downwards in the same line and to the same extent. This first incision should merely pass through the skin, superficial fascia, and fat, so as to expose the fascia lata, shining through which the sartorius muscle is generally seen. The fascia is next carefully divided along the inner edge of the sartorius, at the lower part of the wound, and slit up in the direction and to the full extent of the superficial wound. This exposes the fibres of the sartorius and the fascia covering the sheath of the vessels, under which there is often a quantity of fat. The operator should now trace from above downwards with his finger, so as to feel the pulsation, and so re-assure himself of the exact position of the artery. Without any further dissection, the edge of the sartorius is gently held aside at the part where it begins to overlap the sheath. The fascia is opened immediately over the artery by pinching up a portion of it with the dissecting forceps, and applying the edge of the

* Plate xxix. Figs. 2 and 3.

Fig. 1

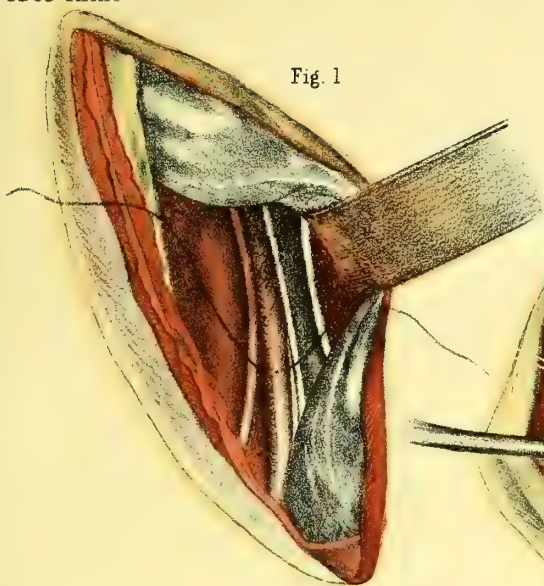


Fig. 4

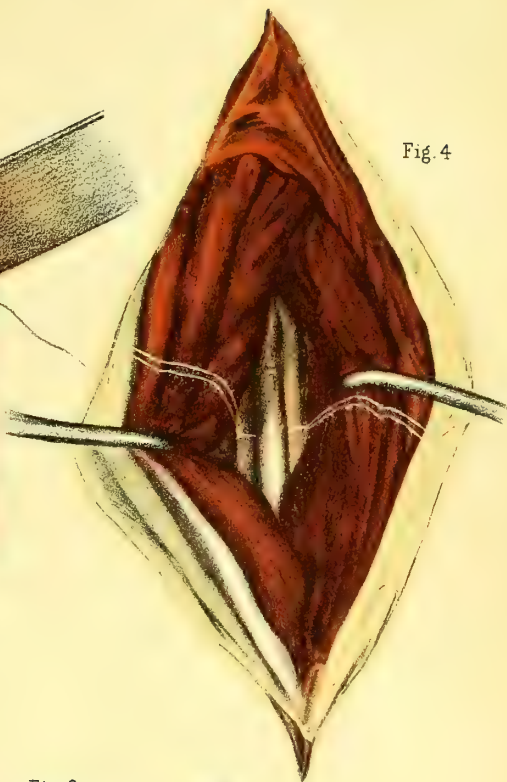


Fig. 2

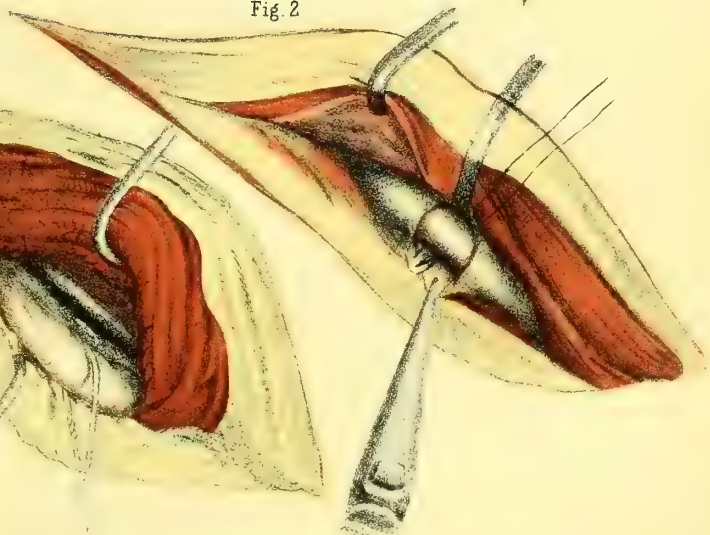
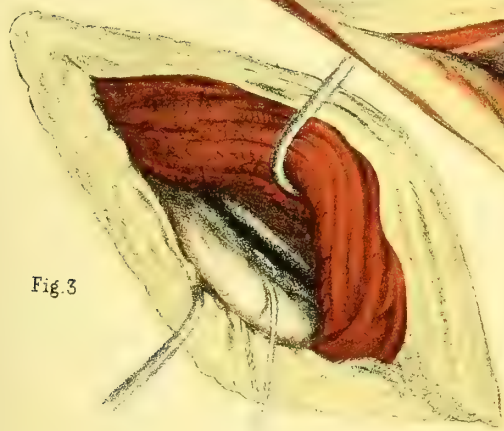


Fig. 3





knife horizontally so as to cut out a small piece. The opening so made is enlarged to the extent of an inch and a half or two inches. When this is done, the inexperienced operator might think that all he had to do was to pass the ligature, for the vessel comes into view full and rounded. But the most important steps of the operation yet remain to be performed—namely, opening the proper sheath of the vessels, and insulating the artery, for passing the ligature round it. The surgeon should raise a portion of the sheath, and open it in the same manner as he opened the fascia; and when he has, with the point of his knife, sufficiently cleared the sheath from the artery on its inner aspect, he seizes the margin so cleared with a pair of catch-artery forceps, and lets them rest on the inside of the limb, so as to fix the opening in the sheath (Fig. 2, Plate xxix.) Then, laying hold of the external edge of the opening in the sheath with the dissecting-forceps, he clears the artery from it in the same way and to the same extent as on its inner aspect, so that the armed aneurism needle may be passed without any force or undue disturbance of parts. Perhaps there is no artery in the deligation of which greater care is requisite in opening the sheath and clearing the artery than the femoral. The vein lies completely behind the artery at the point where it is usually tied, always closely, often firmly, connected to it, much more so than is the case in other vessels; and if the artery be not properly insulated, any attempt to force the needle between the artery and vein is almost certain to wound the latter. The artery should be fairly cleared for about two lines round its circumference, so as to allow the needle to be passed easily. The opening of the sheath in front is of course larger, a quarter of an inch or so, to enable the surgeon to see the parts. The aneurism needle is generally directed to be passed from within outwards; but as the vein lies quite behind, it is immaterial from which side we pass it, if we only attend to the clearing of the artery already spoken of. Should the needle, by any accident, puncture the vein, it should be at once withdrawn and passed more carefully. If the thread be tied, and allowed to remain, the

venous bleeding will be arrested, owing to the diminished arterial supply ; but the ligature so left will keep up irritation, and lead to phlebitis, obstruction of the vein, and gangrene. The accident is a very dangerous one ; but we give the patient the best chance by withdrawing the needle and ligature, and passing the needle again so as to avoid the injured vein. By doing this at once, the puncture in the vein may heal, and no bad consequence follow. When the needle is so far passed round the artery that its eye and the ligature can be seen, the surgeon should seize the loop of the ligature with his dissecting-forceps, and then withdraw the aneurism needle ; this avoids all unnecessary traction on the vessel or destruction of its vital connections. The ligature is then to be firmly tied with the reef-knot, and both ends twisted so as to form one cord, which is brought out exactly opposite the point of deligation. The wound is then washed out with a little cold water, and its margins closed by a few points of suture. Two narrow flat pads of lint are placed, one on either side of the incision, and retained by strips of plaster, to keep the superficial in apposition with the deeper textures. The limb below the knee should be enclosed in a sheet of cotton wadding, and laid on its outer side, slightly flexed, on a water-pillow, moderately filled with barely tepid water. No external heat should be applied to the limb or foot.

Ligature of the femoral lower down, in Hunter's canal, is only performed in exceptional cases. I have referred formerly to a case of varicose aneurism, where I tied the femoral both in Scarpa's triangle and Hunter's canal, so as to include the aneurism between the deligated points ; and the details of the operation are given in the clinical cases illustrative of the treatment of aneurism. But the cases where ligature of the femoral in Hunter's canal is required are very rare. When, however, the surgeon finds it necessary to perform such an operation, it may be accomplished in the following manner. The surgeon, having ascertained the position and breadth of the sartorius muscle, as in the higher operation, makes an incision fully three

inches in length along its *outer* margin. This incision should divide the integuments, superficial fascia, and fat. The operator next incises the fascia lata to the same extent, so as fully to expose the edge of the sartorius. If the fascia be very strong and aponeurotic, it is advisable to divide the fascia across the line of the sartorius by a small transverse incision about the middle of the longitudinal one, to allow of the muscle being drawn fully to the inner side, as, at the part where the artery is to be tied, the sartorius does not merely overlap, but completely covers the aponeurotic canal enclosing the vessels. When the sartorius has been separated and drawn inwards, the strong tendinous aponeurosis forming the anterior wall of Hunter's canal is exposed. This should be carefully opened with the point of the knife, and then slit open more fully with a probe-pointed bistoury, to avoid all risk, as the aponeurosis is very closely applied upon the contained vessels. The proper sheath of the vessels is then opened, and the armed aneurism needle passed with the same precautions as in the higher operation, and the treatment of the wound and limb is similar in both cases.

When, from any cause, as in my case of traumatic varicose aneurism formerly alluded to, the sartorius is adherent, so that it cannot be fully drawn aside, I would advise its complete division to facilitate the deligation of the artery. The adhesions above and below would prevent the divided ends retracting very far from each other, and union ultimately would take place with little, if any, loss of muscular power, whilst we avoid unnecessary manipulation in the vicinity of the vessels.

In tying the femoral by the direct method in a case of false aneurism, or for wounds, the incision should be free, to enable the surgeon to see the parts distinctly, so as to avoid injury of the vein. The artery is commanded above by the tourniquet, and the sac of the false aneurism opened in accordance with the general principles laid down in Lecture lxxi., pages 558-59. In cases of circumscribed false femoral aneurism, I have already indicated my reasons for preferring ligature of the femoral on the Hunterian principle in Scarpa's triangle.

The principal anastomoses which restore the circulation in the leg and foot after ligature of the femoral artery, are : 1. The long descending branches of the external circumflex artery inosculating with the superior external articular of the popliteal, and with other small branches of the popliteal at the outside and front of the knee. 2. The obturator artery and descending branches from the internal circumflex, with muscular branches, and with recurrent branches from the *anastomotica magna* below. 3. The arterial chain of communication formed by the three perforating-arteries inosculating with each other, and superiorly with the gluteal, sciatic, and transverse branches of the external circumflex, whilst inferiorly they communicate with the articular and other branches of the popliteal artery. 4. The anastomoses of the terminal branches of the *profunda* with the *anastomotica magna*, the superior articular, and other branches from the popliteal. The tibial recurrent and the inosculations of the *anastomotica magna* with the articular arteries, assist, especially in cases where, as in popliteal aneurism, some of the articular arteries are obstructed at their origin from the popliteal.

Ligature of the arteries of the leg is seldom required, except in cases of wounds, or of false aneurism resulting from wounds, and as the wound should in general form part of our incision in such lesions, this will modify the operative procedure in different cases. Nevertheless, as in the arteries of the forearm, the line of incision should come as directly as possible upon the wounded vessel, and be determined by certain anatomical guides. I shall therefore describe very briefly the operations for exposing and tying these arteries.

The popliteal artery, almost immediately after it has passed beyond the lower margin of the popliteus muscle, divides into the anterior and posterior tibial arteries. The ANTERIOR TIBIAL ARTERY passes directly forwards through the interosseous membrane, and then continues to pass downwards, lying upon the anterior surface of that membrane, in a slightly oblique course from above downwards and forwards, till it reaches the fore part of the ankle, where it receives the name of anterior pedal artery. In

Fig. 1

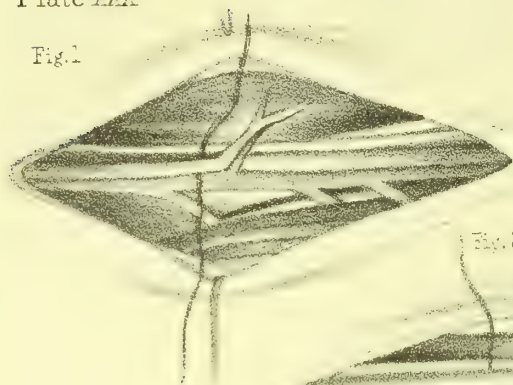


Fig. 2

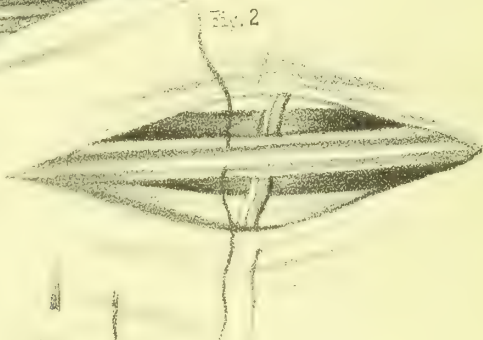


Fig. 3

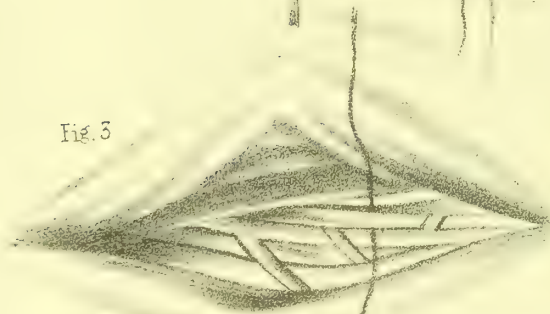


Fig. 4

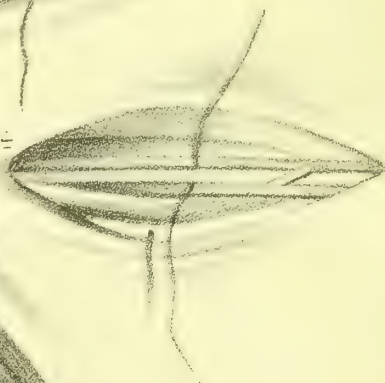


Fig. 5



this course the vessel with its venæ comites is very deeply seated in the two upper thirds of the leg, having the anterior tibial nerve at first external and then crossing it in a very oblique manner, so as to lie rather in front for a considerable distance. It lies at first deeply seated between the outer side of the tibialis anticus muscle and the extensor digitorum communis; and, owing to the prismatic form of the tibialis anticus, the broad superficial part of the muscle fairly overlaps the vessel. Lower down in the leg the extensor proprius pollicis, arising from the fibula and interosseous membranes, intervenes between the extensor communis and the artery, so that, for nearly the lower three-fourths of the leg, the artery is placed between the extensor of the great toe and the tibial muscle. Nearer the ankle the tibial muscle, becoming tendinous, passes forwards and inwards, out of relation to the artery, which then lies between the extensor of the great toe and the common extensor of the toes, the former to its internal side.

The best guide to the position of the anterior tibial artery, either at the upper or middle parts of the leg, is the outer edge of the tibialis anticus. This muscle is very broad above, and narrows as it descends.

Operation.—To tie the artery in the upper fourth of its course, the surgeon should make a long incision, slightly oblique, so as to follow the margin of the tibial muscle. This incision should not pass deeper than the surface of the aponeurotic fascia binding down the muscles, so that the operator may recognise the intermuscular line which separates the tibialis anticus from the common extensor. He should recollect that the upper portion of the latter muscle is very narrow, not above three lines in breadth, and that he is very apt to open the intermuscular line between it and the peroneus longus, and thus be led away from the artery. The assistant should be desired to extend and relax the ankle alternately, so as to show the outline of the tibialis anticus, before the fascia is opened, in the intermuscular line. The surgeon, with his finger or the handle of the scalpel, then separates the muscles and makes the assistant hold them forcibly apart. This exposes the vessels and nerve at the bottom of a deep and confined wound.

The artery is next cleared from its *venæ comites* and the nerve, the armed needle passed, and the vessel secured.

In the middle of the leg the vessel is reached more easily, as the depth of the interosseous space has diminished, and also the bulk and depth of the muscles. The incision is similar to that in the operation just described—along the outer edge of the *tibialis anticus*; but here the surgeon must recollect that that muscle is narrower, and that the extensor of the great toe is the muscle in relation with the vessels externally. In other respects the steps of both operations are similar.

The POSTERIOR TIBIAL ARTERY is the direct continuation of the popliteal, and continues to descend a little to the internal side of the middle line of the leg, resting upon the *tibialis posticus* and *flexor communis* muscles, which separate it from the posterior surface of the interosseous membrane, until it reaches the hollow or arch of the calcaneum, where it terminates in the internal and external plantar arteries. About eight or ten lines below its origin, the posterior tibial gives off a large artery, or, more properly speaking, subdivides into the posterior tibial proper and the peroneal or fibular artery. This latter is very often the larger of the two vessels; in ordinary circumstances the peroneal artery descends for about two and a half or three inches parallel to and on the same plane as the posterior tibial, but gradually gets covered by the mass of the long flexor of the great toe, and so passes out of sight, and ultimately terminates in anterior and posterior interosseous branches, communicating both with the anterior and posterior tibial arteries and their malleolar branches. When the peroneal is the larger branch it takes the same course, but a little above the ankle it emerges from under the flexor of the great toe, and again joins the posterior tibial; so that, however small that vessel may be in the upper part of the leg, it is always found of large size behind the inner ankle. The great posterior tibial nerve descends almost exactly in the middle line of the leg, so that it lies immediately external to the posterior tibial artery and its accompanying veins, and internal to the peroneal artery—in other

words, exactly between, and in close relation to, both these vessels, so that it forms an unerring guide in the deep part of the wound, by which we may reach either vessel. The vessels and nerve are separated from the soleus by a layer of thin but strong fascia, which binds them to the deeper muscles. Then they are covered by the soleus and gastrocnemius muscles, fascia, and skin. Lower down, where the muscles of the calf of the leg have terminated in the tendo achillis, the posterior tibial is covered merely by the skin, superficial and deep fascia, and its course can be readily recognised by its pulsations.

The plan of operation which is very generally advised for tying the posterior tibial in the upper part of its course, is by means of a long incision through the integuments corresponding to the external or fibular border of the tibia, next dividing the fascia, and drawing outwards the inner margin of the gastrocnemius, and then either detaching the tibial origin of the soleus from the bone, or dividing its fibres from the surface towards the artery.

I consider that such a plan is not well suited to effect the purpose in the living, and that the direct plan recommended by the late Mr. Guthrie is much better, as enabling us to reach the vessel more directly, and really with less disturbance or dissection of parts; whilst, if it happens that the peroneal is the vessel requiring to be tied, that can be effected without any alteration of the original incision. I have twice had occasion to tie the posterior tibial—once at the middle, and once at the upper part of the leg; and from my experience in these cases, I have no hesitation in recommending the mesial or direct operation. In the former of these cases the vessel required to be secured in a lacerated wound, and hence the direct operation consisted merely in enlarging the original wound and tying the vessel. In the latter the operation was undertaken to secure the posterior tibial at its highest point on account of an arterial erectile tumour, apparently directly connected with it. In that case the posterior tibial was found to be very small, and its ligature produced no effect on the pulsation of the tumour; but, having taken the

direct method, all I had to do was to clear the parts to the outer side of the posterior tibial nerve, and tie the peroneal, which was nearly thrice the size of the tibial. Had I followed the lateral incision, and the exposure of the parts been less complete, the operation would have been very much more complicated.

The plan of operation which I followed on that occasion, and which I would recommend, was as follows:—I made an incision about six inches long, through the integuments on the back of the leg, dividing the skin and fascia. The posterior saphena vein was then cleared and held aside, and the incision continued, so as to separate the two heads of the gastrocnemius, to the extent of the superficial wound. One or two small vessels only required to be secured. I next divided the fibres of the soleus directly from behind forwards, till I recognised its deep aponeurotic surface. This I divided cautiously about the middle of the wound, and then with a probe-pointed bistoury dilated the opening upwards and downwards to the full extent of the superficial incision; two or three small muscular branches were secured, and the deep fascia slit up. The pulsating tumour then projected and filled the wound, but was gently held aside, and rendered less turgid by compression on the femoral. The posterior tibial nerve was now very distinctly seen, and the posterior tibial and its veins readily recognised and the artery tied; but, as I have said, it was very small and produced no effect. Seeing this, I slightly dissected the tissues on the outside of the nerve, and drew aside a vein which hid the peroneal artery, exposed that vessel, and tied it. The presence of the erectile tumour in this case rendered the operation more difficult than in ordinary circumstances: yet, the comparative ease with which the vessel was reached, and the parts at the bottom of the wound seen, render it in my estimation infinitely superior to working in a confined wound, the most important part of which is very imperfectly exposed. There is really no division of muscular fibres, except in the case of the soleus; for the two origins of the gastrocnemius are merely separated along their aponeurotic line of union, and the tendon of the plantaris drawn aside.

To tie the artery behind the inner ankle, the surgeon makes an incision of two inches long, placed nearly midway between the inner side of the tendo achillis and the inner border of the tibia and internal malleolus, care being taken to avoid the saphena vein. When the integuments and fat are divided, the strong aponeurosis which covers in the vessels is brought into view and slit open, the posterior tibial nerve is seen; and lying nearer the tibia, just behind the sheath enclosing the tibialis posticus and common flexor tendons, is the artery, with accompanying veins, from which it can be readily separated, and the ligature passed and tied.

LECTURE LXXIX.

Excision of Joints—History of the Operation—Its benefits as compared with those of Amputation—The Objects sought to be attained by the Operation—How these are Modified by Circumstances—Considerations for our Guidance in the Selection of suitable Cases for Operation : as regards the Patient, and the Extremity and Articulation affected.

AMONGST the improvements which mark the progress of modern surgery in our day, there is none which, in my opinion, deserves a higher place than EXCISION OF JOINTS as a substitute for amputation. In properly-chosen cases the results are most satisfactory, and the operation is more truly conservative than many methods of treatment which are so called. Whatever difference of opinion may exist as to certain excisions in the lower extremity, all who have witnessed the satisfactory results of excisions in the upper extremity, especially those of the elbow and shoulder joint, must admit the benefits conferred by these operations when contrasted with those derived from amputation of the limb.

Looking at the question of excision of diseased or injured joints, as seen in the results of modern surgical practice, you may be apt to wonder that such operations had not been had recourse to and become the rule of practice long ago. For excision of diseased joints is not a new operation. To say nothing of indications of complete or partial excisions of joints in ancient writers ; we find excision of joints not only practised by English and French surgeons, but special attention drawn to it by them as a plan of treatment suitable to diseased joints and as saving a useful limb ; whilst the results of their cases, and the arguments they adduce in favour of excision, leave very little to be added in the present day. Thus in England excision of the knee

was successfully performed by Mr. Park of Liverpool in 1781, and his views on the advantage of excisions in general were published in the form of a letter to Mr. Percival Pott in 1782, and also in the *London Medical Journal* in 1789. Mr. Park also mentions a case in which Mr. Filkin, a surgeon at Northwich, had performed excision in a case of diseased knee complicated by injury in 1762. Excision of the head of the humerus had also been performed by White of Manchester and Mr. Bent. And in France the Moreaus, father and son, practised excision of joints as a general rule, and the younger Moreau published a work on the subject. Notwithstanding all the success which had attended excisions of joints both in England and France, the operation never came into general use; and it is undoubtedly to Mr. Syme that we owe its revival and advancement as a general method in the present day. Mr. Syme's work on Excision of Joints, published in 1831, drew general attention to the subject, and the success which attended his operations induced many surgeons to perform excision of the elbow-joint instead of amputation. Still the general adoption of the method was much less rapid than might have been expected from the success of the operation and the advantages to be gained by it. This partly arose from some surgeons misunderstanding the objects of the operation—viz. to remove the whole of the articular ends of the bones, and to obtain a movable elbow by means of a false joint. Some placed the limb after excision in rectangular splints, and kept it in the bent position to obtain ankylosis. Still more detrimental to the credit of the operation were the attempts to perform partial excision, such as resection of the olecranon or portions of the condyles of the humerus, which attempts were very generally followed by increased local mischief and grave constitutional disturbance, sometimes terminating fatally or requiring amputation of the arm secondarily. And then many surgeons, forgetting how long it is before the soft parts in the neighbourhood of a diseased joint regain their healthy character after excision, and how frequently in such cases sinuses form from time to time, took alarm, and not unfrequently performed

amputation secondarily, when a little patience and reliance on the curative powers of nature would have saved the limb.

I need not, however, dwell longer on the causes which delayed the general adoption of excision of joints in operative surgery, as it is now recognised as one of the greatest improvements in modern surgery ; but I rather draw your attention to the objects which we seek to accomplish in performing excision of a joint, and how these are modified in regard to excisions of particular articulations, or in relation to such operations in the upper and lower limbs, and the constitutional condition of the patient; for a variety of considerations must be carefully kept in view, to enable us to perform these operations intelligently, so as to obtain the best results, and to discriminate between cases suitable for excision, and those in which its performance might, from their unfavourable results, bring undeserved discredit on the operation.

In all cases of excision of diseased or injured joints, the paramount consideration is the complete removal of the diseased or injured parts, for unless we can accomplish this the operation is imperfect, and the result cannot be expected to be successful. The next consideration is to obtain as useful a limb as possible. Here our object, and consequently our mode of procedure, will vary, according as the excision is in the upper or lower limb. In the former, our object is to obtain a movable articulation, to admit of the free use of the arm and forearm. In the lower extremity a movable articulation renders the limb useless as a support, less useful than an artificial limb, and hence our object in such cases is to procure firm ankylosis in the straight position. In all cases our operations for excision should be effected with as little disturbance of parts as is consistent with the thorough removal of diseased structures. Finally, the risks to life, as compared with amputation, require to be considered in certain excisions, whether as depending on the state of the patient's health, predisposition to pulmonary or renal disease especially, or as depending on the dangers incident to particular excisions.

As regards the objects mentioned, all surgeons must admit

that we are very differently situated in regard to our power of effecting them in excisions of the upper and lower limbs.

In the former, if we perform the operation intelligently in reference to the objects to be accomplished, we can in general effect these fully and obtain brilliant results ; whilst in the articulations of the lower extremity, the paramount object,—that of removing all diseased structure,—cannot always be fully accomplished in some, whilst in others we are obliged to sacrifice the mobility of the joint to the necessity of having a sufficient support. I shall, therefore, first speak of the excisions of the upper extremity, as affording the most perfect examples of this operation.

In performing excision of the articulations of the upper extremity, we wish to remove all disease and to obtain a false articulation, which, under the control of the muscles, will admit of either the natural movements of the joint, or movements so closely resembling them that the use of the limb is but little impaired.

To effect these objects, we require to plan our incisions so that they may avoid division of muscles or tendons, so far as compatible with exposure of parts necessary for the complete removal of the diseased structures. With this view our incisions should be parallel to the axis of the limb, or nearly so, that the cicatrices may not interfere with the movements of the joint subsequently to the cure, and to facilitate the after-treatment and permit of passive motion being begun at an early period, even before the union of the wound has taken place ; this is specially important in the case of excisions of the elbow, but the principle is applicable to all excisions of the upper extremity. So far as possible, complete transverse division of muscles or tendons should be avoided, by making our section of muscular fibres more or less oblique, so that the divided fibres may unite more readily and with less loss of power. For example, in dividing the attachment of the triceps in excising the elbow, I divide it freely, from and on either side of the olecranon, by two oblique incisions uniting above at an acute angle so as to form

an inverted Λ , instead of cutting it across as is often done. Of course all tendons and muscles, attached to and covering the capsular ligament of a joint, as in the shoulder, should be thoroughly divided by a bold incision, so as to enable us to disarticulate easily; and so must all muscles or tendons attached to parts of bone which are to be removed. In dealing with the diseased textures, all the affected synovial membrane present should be removed, by dissecting it off or by touching any small patches which are adherent with nitrate of silver, solution of chloride of zinc or perchloride of iron, or strong tincture of iodine. I generally use the chloride of zinc, and in cases of marked gelatinous degeneration I usually brush the surface of the wound with the solution when the resection is completed. In such cases, where we have diseased tissues, the chloride of zinc seems to produce a more healthy form of action, limiting suppuration and tending to more rapid consolidation of the parts. As regards the resection of the bones, all the articular surface entering into the formation of the joint must be sawn off, not only to an extent sufficient to remove the disease thoroughly, but when we wish to obtain a movable articulation by the formation of a false joint, we must remove some healthy bone beyond, so as to prevent the risk of coalescence of the resected bones and ankylosis occurring during the progress of the cure. From what I have observed of excisions of the elbow, I think the full benefits of the excision are often lost in consequence of not removing a sufficient quantity of bone, from the dread of leaving a "flail-like joint," a very rare occurrence indeed. Again, the surgeon is liable to be misled as to the amount of the articular extremities of the bones he has removed, if the mere bulk is looked to, for the excited action has generally caused enlargement of the bones and deposition of new bone around. I make it a rule to judge of the extent to be removed by the anatomical marks of the bones; thus, in the elbow I invariably saw through the condyloid portion of the humerus high up; indeed, if that bone be sawn through its flattened portion immediately above the olecranon and coronoid

fossæ, and the ulna divided below the base of the coronoid process, and the radius immediately below its head, there is no fear of a bad result. Whereas, if too little bone be removed, the risk of ankylosis is very considerable, especially in young subjects; and I have noticed this more particularly in cases in which the excision had been performed to remedy ankylosis arising from injuries, where the increased bulk and altered form of the bones are more apt to mislead. In such cases, the removal of bone should be very free. The only case of loose "flail-like" false joint I have met with in my own practice was in the case of a very debilitated man, in whom, owing to the extent of disease, I was obliged to saw through the humerus at the lower part of the shaft, quite above the condyloid part. It is now several years since the operation was performed, and though consumptive and apparently very weak, he still lives. When the arm hangs at rest, it certainly has a very "flail-like" and useless appearance; but when he calls the muscles into action, he has complete power over the joint, and can raise and sustain considerable weights—in fact he has very perfect use of the arm and hand. So that even this extreme case shows that a loose joint is not so very disastrous, and not likely to happen in ordinary cases. I have never had to regret removing too much bone in excisions of the elbow, but I can look back on cases in my earlier practice when I could wish I had removed more. Whilst on this subject, I confess that, holding the views I do, I am rather at a loss to understand the principle, on which dissecting off the periosteum below the point of section of the bone, and retaining it, is advocated; the object in doing so must be to favour the formation of the new bone, and that just renders the risk of ankylosis greater. I can perfectly understand it in cases of resection of the knee, where we desire a firm osseous union, but I must say I think it objectionable in cases where we desire a movable false joint after excision.

In excisions of the lower extremity, in which, as already explained, we aim at obtaining a firmly-ankylosed joint, to afford support to the body, in so far as our objects differ, so must our

methods of operation and after-treatment. The complete removal of all diseased tissue is equally imperative as in the excisions of the upper extremity, but here we limit ourselves to the least possible removal of bone compatible with the complete removal of disease. In many cases, after making our section of the condyles of the femur and tibia, we may find that the osseous surface still presents traces of disease, often in the form of parts of cavities containing tubercular-looking matter, or of points where the bone seems unhealthy. If the general surface of the divided bone seems unhealthy, then we require to remove a fresh section, and I think it better to do so then than to remove too large a section of bone at first, from the apprehension of diseased structure, which possibly or probably does not exist. In the cases where the cut surfaces present the remains of cavities, or small parts where the bone seems unhealthy, I consider the use of the gouge, and touching the surface with iodine, perchloride of iron, or chloride of zinc, quite sufficient, without requiring a fresh section, and consequent larger removal of bone. As regards our division of the soft parts, the complete division of muscles or the direction of our incision through the skin is of less consequence than when we want to obtain a movable articulation. Indeed, we often divide the hamstring muscles when the knee has been contracted, either as a preliminary or after resection of the bones, to enable us more easily to bring and retain the osseous surfaces in accurate apposition; whilst, in regard to the line of incision through the integument in the knee-joint excision, I feel satisfied that a slightly convex incision transversely from condyle to condyle below the patella is by far the simplest method of operating; the firm cicatrix, in this instance, is itself useful in giving solidity in front of the knee. In cases of excision of the hip and ankle, parts of the incisions must nearly always be transverse or curved.

Much has been said and written as to the comparative advantages of excision of the knee-joint over amputation, for disease of that joint. Objections have been made to excision, first, on account of the greater risk to life, and secondly, because of the

protracted cure and the nature of the limb preserved by the operation. In regard to the comparative risks to life, I shall have to consider that subject hereafter. At present I shall merely treat of the objections to the results of the operation in the cases where the patient ultimately recovers. It is quite true that the treatment of a patient after excision of the knee-joint is necessarily much more protracted than after amputation of the thigh; for, even supposing the wound to heal completely by the first intention, the limb must still be kept slung for at least seven or eight weeks, to insure solid union, and prevent the risk of bending; and even after the patient is able to move about with crutches, some time must elapse before much weight can with propriety be borne on the limb. In referring to these objections, Mr. Syme, in his work on excision, has well observed—"It ought to be recollected, too, that though recovery from amputation of the thigh is usually completed in three or four weeks, it is generally *at least as many months* before the patient can rest the weight of his body on the face of the stump, so as to use it in standing or walking. As to the utility of the limb, we find that it can be employed freely in progressive motion, and all the patients have declared that they considered themselves extremely fortunate in having preserved their legs such as they were. The advantages of the operation which may be contended for, are, that it preserves the natural support of the body afforded by the bones and joints of the tarsus, metatarsus, and toes, which, by diffusing the effects of force applied at the extremity of the limb, protects both it and the other parts of the body from concussion; and that it obviates the necessity of resting the whole of the patient's weight on the face of a stump, which must be done when amputation is performed above the knee."

Mr. Syme might have stated a longer period as being necessary before a patient should use an artificial limb; after amputation, I think at least eight months should elapse, after the stump has healed, before a support is used. As to the objection that the limb left is little, if at all, more useful than an artificial support, the advantages stated by Mr. Syme are fully corroborated.

rated by experience in the cases on which I have myself operated, and the larger experience of other surgeons. The results, as to the use of the limb and the little lameness observable in walking, have, I confess, surprised me. In one case of a young woman, on whom I operated in 1858, and in whom I removed more than the usual amount of bone, having thought it necessary to remove a second section from the condyles of the femur, I dreaded that the lameness would be very great, and she had a high-heeled boot fitted for the foot of the affected limb. A year afterwards I was astonished to see her at the hospital walking with scarcely a perceptible halt, and she informed me that the high-heeled boot hindered her walking, and, on using an ordinary shoe, she found her ease in movement so much greater that she had thrown aside the high-heeled boot; and this, I may state, has been the experience of all my patients, viz. that they walk best with a shoe or boot similar to that on the healthy foot. In other words, the obliquity of the pelvis, though scarcely noticeable, compensates for the shortening, whilst the movements of the hip and ankle joints compensate for the loss of motion in the knee; so that, in most cases, the limb left after excision of the knee-joint is very different from an artificial support, as regards the ease of the patient's progression. But, to take another aspect of this objection,—no surgeon would hesitate to prefer cure by ankylosis in the straight position in a case of diseased knee, to amputation of the limb. Now, that is just the result obtained by excision.

In some cases it would appear that a joint which, after resection, was pretty firmly ankylosed, may gradually, from alteration in the bones, become movable, and form a false joint. I recently saw a patient under the care of my colleague Dr. Gillespie, in whom that gentleman had excised the knee, with a favourable result, three years ago, so that the man returned to his occupation, that of a miner. Gradually, however, his health became impaired, and he had pains in the parts near the wound. The ankylosis gradually gave way, and, after a variety of treatment, he insisted on amputation being performed. On section of the

parts, the condyloid portion of the femur was found atrophied, and its lateral section looks precisely like the bone from a stump of the thigh. A false joint had formed, and the femur worked like a pivot in a corresponding cavity in the head of the tibia. The original section of the femur, in the excision, was made through the upper part of the condyles. Deep in the head of the tibia a tubercular abscess was exposed by the dissection. I believe that the cause of alteration and atrophy was connected with the tendency to disease and the state of the constitution, and that, except for these conditions, amputation would not have been called for.

Such cases must be considered as very exceptional, and as by no means forming a valid objection to excision of the knee, only warning us to be careful in discriminating in our diagnosis what cases admit of thorough removal of the whole disease by resection.

Sir William Ferguson, in his interesting and instructive lectures on the progress of modern surgery, shows the great advantages gained by excision of the knee in successful cases, and his own practice has had great influence in giving excision of the knee its present position as a recognised operation in surgery. In the lectures I have alluded to he advocates its claims very strongly, perhaps rather exaggerates them. For, with all my appreciation of the advantages of the operation in certain cases, I am not insensible to the dangers attending it, and the necessity for discriminating as to the cases in which it should be performed, or to the inconvenience which may occasionally result when the resected joint remains very movable, or when the limb is not developed in proportion to the sound one, so as to be very much shorter. I cannot think that the sketch he gives at page 142 is likely to impress many with the advantage of excision over amputation, and I believe that, if that sketch were contrasted with a patient after amputation fitted with a good artificial limb, the contrast would rather be unfavourable to excision.

In regard to the EXCISION OF THE HIP-JOINT, I think that, looking to the pathology of morbus coxarius, and the extent to which

the acetabulum is generally affected at the stage in which we would be warranted in abandoning other curative measures and recommending excision, I doubt whether we could ever be sure of removing the whole diseased structure,—in other words, whether we could effect what I have stated as the paramount object of excision of a joint. It has been said that this resection is analogous to the excision of the shoulder, where we seldom require to remove more than the head and tuberosities of the humerus. The two cases are essentially different in many respects—first, the disease in the shoulder-joint is very generally confined to the head and tuberosities of the humerus, very often commencing in the latter, or in the upper part of the bicipital groove; whilst I cannot recollect of ever having seen a specimen of morbus coxarius where the acetabulum was not affected, and generally to a great extent. But, apart from the foregoing considerations, the great practical difference lies in this, that the scapula does not form a part of any of the great cavities of the body, so that we can remove, if necessary, not only the diseased surface of the glenoid cavity, or indeed that cavity entirely, by curved bone-forceps, but even a large portion of the scapula, or the whole bone; whereas, in morbus coxarius, the acetabulum, if largely diseased, could not be so dealt with, as it forms a part of the walls of the pelvic cavity. In cases of advanced hip-joint disease, where the carious and dislocated head of the femur is felt bare through some sinus, or in the cavity of an abscess, I should consider it advisable to lay the sinus or abscess freely open, and resect and remove the carious portion of bone; but I cannot see much likelihood of excision of the hip-joint (properly so called) becoming a successful operation.

EXCISION OF THE ANKLE-JOINT, for disease, is a comparatively rare operation: by proper care and treatment, when the disease occurs in young persons, and where it is limited to the joint, a cure by ankylosis can generally be effected. Persons above middle age are rarely the subjects of such disease, and if they were, excisions are not very successful at that period of life; whilst, if any of the tarsal bones, except the upper articular

surface of the astragalus, be involved in the disease, I consider amputation at the ankle the more suitable measure. But, though I have had no personal experience in regard to excision of the ankle-joint for disease, I can conceive of some cases where it might be practised with advantage ; and from what I know of the ease with which the articular surfaces can be removed in compound dislocations of the ankle, without injury to the blood-vessels or tendons round the ankle-joint, I think that, in cases of disease proper for the operation, it might be readily accomplished, without dividing any important structures, so as to leave a very useful limb, preserving the movements of the foot, so that I should be inclined to perform it if I met with a suitable case.

In regard to partial resections of the foot for removal of diseased bones, except in the case of cario-necrosis of the os calcis, from what I have seen of such resections, and experience of my own cases, I have a very unfavourable opinion of such operations. I have, in some cases, removed one of the cuneiform bones, and also the cuboid, with success ; but in most cases these operations are followed by mischief in the neighbouring tarsal articulations and bones, erysipelatous inflammation of the foot sets in, accompanied by irritative fever, and amputation of the foot, or, it may be, of the leg, is ultimately required, if the patient escapes the dangers of irritative fever or pyæmia. I believe that such operations are attended with much greater risk to the patient's life than the results of even occasional successes warrant us to encounter, and hence I prefer non-interference in such cases, or merely gouging out the carious surface, without meddling with the articular surfaces ; or, when interference is imperative, I consider either partial amputation of the foot, or at the ankle, the safer practice—the more so, that in such cases all the tarsal bones are generally predisposed to disease ; so that, even in cases where partial excisions have been temporarily successful, the disease often returns in other portions of the tarsus, and amputation has at last to be resorted to. In these general remarks on excision of joints I have almost entirely re-

ferred to the operation as performed for disease. In my lectures on gunshot wounds I very specially pointed out its advantages as a primary operation, and the great success which had attended its performance by military surgeons. The same results would follow its performance in similar cases in civil practice ; but, unfortunately, the compound dislocations, or fractures, met with in civil practice, are attended with so much destruction of soft textures, or so complicated with other severe injuries, as either to forbid the operation, or to leave but little chance of success ; but in proper cases, especially in the upper extremity, it ought certainly to be practised in preference to amputation.

LECTURE LXXX.

Comparative Mortality following Excision and Amputation in Upper and Lower Limbs, as seen from Statistics—Causes of the Mortality exemplified by Illustrative Cases—Instruments and Apparatus required for the Operation and After-treatment of Excision of Joints.

THE question of the comparative mortality in cases of excision of joints and of amputation can, I think, have reference only to these operations in the lower extremity. In the upper extremity a fatal issue after excision is very rare as compared with amputation. As regards my experience in my own practice, I find that out of 112 cases of excision of the elbow-joint I have lost only 6 cases. In 17 cases of excision at the shoulder-joint I have met with no fatal result ; and in 8 cases of excision of the wrist I have met with no fatal case, but in two of these last, amputation of the forearm was required subsequently. Of the 6 fatal cases of excision of the elbow, 2 died of acute pyæmia, 1 of pyæmia complicated with acute albuminuria. In one case, the patient, a young man, died of albuminuria five months after the operation. The symptoms began to develop themselves six weeks after the operation, and the wound of the operation was healed four weeks before death. The fifth fatal case resulted after the only primary excision which I have had an opportunity of performing, and the young man had sustained numerous injuries—namely, cerebral concussion and fracture of the ribs. He died the third day after admission into the hospital. In the sixth case—a very emaciated child with phosphaturia—the wound would not heal, amputation was performed, but he gradually sank exhausted. It seems to me that excisions of the upper limb are attended with less danger to life than any other operation of equal severity.

In regard to these statistics of my experience in the

excisions of the upper extremity, I have been struck with the great difference in the number of excisions of the wrist and shoulder in comparison with those of the elbow-joint.

Looking over my journals of private and hospital cases, I find that this disproportion seems due to three causes :—*1st*, That diseases of the wrist and shoulder seem to be of very much rarer occurrence ; and *2dly*, That they are in the early stages more amenable to treatment ; and *lastly*, That many refuse to submit to any operation till the parts are so disorganised and the health so bad that amputation is the only resource. In one year alone I find that of 7 cases of disease of the shoulder 5 were dismissed cured by the use of the cautery, combined with the use of cod-liver oil, iodide of potash, and nutrient diet, whilst only 2 required excision ; whilst in the same year 5 cases of wrist-disease occurred,—two refused to consent to excision, and were relieved by treatment, one was dismissed cured, in one amputation was performed, and one underwent excision, and recovered.

In the lower extremity the results in regard to life are not so favourable. Excision of the knee-joint, so far as the operation has yet been tested, can scarcely contrast favourably with amputation at the lower part of the thigh for disease of the knee-joint. I am aware that favourable comparisons have been made by contrasting cases of excision of the knee-joint with amputation of the thigh generally ; but the comparison, to be a fair one, must be between cases of amputation performed for diseased conditions similar to those for which the excision is had recourse to. My experience of amputation has shown me that, not only the extent of the limb removed, but also the nature of the disease for which it is removed, make a great difference as to the success or fatality of the operation, and that amputation in cases of simple strumous disease of the knee-joint affords the greatest amount of success ; and this is the class of cases for which we perform excisions. With all my feeling in favour of excision of the knee-joint as a substitute for amputation of the thigh, I cannot help believing that in certain conditions it is more dangerous than amputation, and that the character of the

operation is likely to be perilled by its being indiscriminately resorted to. In reference to the absolute advantages of excision of the knee over amputation as regards the results in successful cases, no one can doubt that, and I think the question now to be considered in regard to the comparative mortality of these operations is to endeavour to discriminate between the cases in which the one or the other of these operations presents the least risk to life. Here, as in amputation, it is difficult or impossible to gain much from mere general statistics. What we want to know in considering such a point is, all the circumstances of the cases operated on, which may have influenced the result, and hence the surgeon will learn more from, and naturally be more impressed with, the results of his own cases, or of cases which he has opportunities of closely observing. My own experience of excision of the knee-joint is comparatively limited, and therefore, in stating to you the results, any deductions I may draw from my cases are to be regarded as merely suggestive, not positive.

I have performed excision of the knee-joint 18 times ; of these 9 have recovered, and 8 died, and 1 is under treatment. 17 of the cases operated on were for disease, and 1, a primary excision, for injury. 14 of the patients were females, and 4 males. ♀

Of the 9 successful cases 8 were females ; in 6 of these the ages varied from 20 to 25 ; 1 was a little girl, aged 7 ; and 1 was a young man, aged 20.

The diseased conditions for which the operation was performed were as follow :—In the cases of the young adult females there was disease of the articular ends of the bones, leading to ulceration of the cartilages, attended with great local pain and constitutional disturbance ; but in all of them, notwithstanding the severity of their suffering, there was less wasting of the body and less impairment of the general health and strength than might have been expected. In the case of the young man, ankylosis in the bent position had resulted after long-continued disease of knee-joint, which, so far as the history could be ascertained, seemed to have been disease of the bones and cartilages ;

and at the time of his admission into the hospital there were deep-seated pains in the bones, and the section removed showed the existence of articular caries at some points where the osseous ankylosis was incomplete. His general health had previously suffered during the progress of the disease, but he had regained health and strength after the joint became stiff, but was again beginning to suffer, from the pain preventing rest at night. In the case of the female child, the disease was originally gelatinous degeneration, which had yielded to treatment in the hospital on a previous occasion, but had begun afresh. In her case, also, the joint was partially stiff; her general health was beginning to suffer, but she was by no means exhausted at the time of the operation. In this child's case there was very severe hæmorrhage from the bones some hours after the operation, which could only be arrested by a pad of lint, dipped in perchloride of iron, being placed between the condyles of the femur and tibia, and retained for some hours; after its removal no more bleeding occurred.

Of the fatal cases, one was a case of primary excision in a man about 45 years of age, who jumped from a railway carriage whilst the train was in motion. He sustained several other injuries—concussion of brain and a small lacerated wound of the scalp, and simple fracture of the upper arm. The injury of the knee consisted of a very fine semilunar wound (made nearly as cleanly as with a knife), laying open the knee-joint. The convexity of the flap looked upwards—that is, in the direction opposite to that in which we should make the incision in operating. The internal condyle of the femur was fissured, and fragments broken off. No new incisions required to be made. The slices of bone removed were not of any great thickness, and no ligatures were required. At first the injury of the head rendered him restless and difficult to manage, but after a few days the head symptoms passed off, and he went on most favourably for more than three weeks, when suddenly rigors occurred, pyæmia set in, and he died about five weeks after the injury. The lower end of the femur, above the section of the condyles, was found bare, as from acute necrosis. There was no swelling of the thigh to be seen or felt during

life, nor did he complain of uneasiness at the wound, a great part of which was consolidated.

Another of the fatal cases occurred in a man about 30 years of age, of very strumous constitution and spare habit of body, but not very much exhausted by the disease, which was chronic gelatinous degeneration of the synovial membrane. In this case the cause of death was very obscure. The operation was very easily and quickly performed; there was less than the usual amount of bleeding during the operation, and the wound was not a large one. After the operation some venous bleeding occurred, which, however, was quickly and easily arrested by snipping the bandage above the knee and applying cold. There was no bleeding into the cavity of the wound—no distension—and the ends of the bone were kept in accurate apposition; but he never rallied fairly from the operation, and died within forty-eight hours. There was no affection of the lungs or chest to account for death. I presume we must classify the cause under the convenient term of “shock,” though, as he was not at all nervous prior to the operation, and felt nothing of it, and was neither restless nor complained of pain after it, it is difficult to understand in what the “shock” consisted. A lad, aged 19, on whom I operated for gelatinous degeneration, died under peculiarly annoying circumstances. So far as the excised knee-joint was concerned, the wound healed nearly by the first intention, and consolidation proceeded favourably. So little pain did he suffer that he never moved the limb in the slightest degree, and the apparatus never required to be removed for five weeks, and then only to change the bandages for cleanliness. His appetite was good, and he slept well. The only bad symptom was that the pulse was more frequent than consistent with the general symptoms. He was looked upon as convalescent, when suddenly the opposite foot and leg began to swell. The urine, which had formerly been normal, was now found to contain albumen in considerable quantity. Notwithstanding all treatment, the condition proceeded, occasionally yielding for a time, and then becoming worse. He died nearly four months after the operation,

the wound having healed long previously. In two others of the fatal cases the patients were females, one 40 years of age, and the other 45. Both had on former occasions suffered from necrosis of the femur, which had been cured previously to the appearance of the affection of the knee, for which excision was performed. Both did well for some weeks, and then pyæmia, complicated with albuminuria, supervened, and terminated fatally. Pyæmia also proved fatal in the case of a female, aged 35, on whom I performed excision for gelatinous degeneration; and a very acute form of pyæmia caused the death of a young girl on whom I operated on account of acute ulceration of the cartilages, arising from disease of the bone. In this case the girl had suffered excessively from pain and irritative fever before admission into the hospital. I was anxious for a post-mortem examination in the last case, but it was not granted.

Another of the eight fatal cases occurred after excision for ulceration of the cartilages caused by masses of fimbriated bodies from the synovial membrane. The patient, a female, though nervous and excitable, was not by any means weak, but suffered intense pain on moving. The disease, though extensive in surface, was of little depth. The sections of the bones were accordingly very thin, and the bone underlying the sections removed was sound, and rather more solid than usual. All the synovial membrane was carefully removed. The disease seemed so completely local and limited, and the general health so good, that I anticipated a very favourable result, but she became very excited, and depressed mentally, and died within a week after the operation, apparently from constitutional irritation, and without any symptoms of pyæmia. I have entered more fully into the nature of the fatal cases, with the view of directing your attention to some circumstances in regard to them. As to the successful cases, I have only to remark that, with the exception of the little girl, they all presented certain features in common. In all, the disease was in osseous texture, and tolerably limited. All of them were young adults, and in none of them were the general powers of the constitution exhausted, although the local

sufferings were in most of the cases intense. They were, in fact, cases which augured well for the result, and good specimens of a class of cases which I had indicated in some remarks on excision of the knee, in my Clinical Reports 1858-9, as being specially suitable for the operation—viz. “cases where we find severe local disease of the joint, apparently limited, and of long standing, resisting all the usual remedies, and becoming exacerbated whenever the patient tries to use the limb, but where, at the same time, the general health has not suffered in any great degree.” The causes of the issue in the fatal cases are deserving of attention. The result in the case of primary excision is scarcely to be wondered at. The man was above middle age, intemperate, and suffered various other injuries ; and it accords with my experience of primary amputations, that the presence of other lesions, although not even very dangerous in themselves, such as simple fracture of another limb, or slight injury of the head, have always a most marked influence in determining an unfavourable issue at a late period, and in an insidious form, as in the case alluded to, apparently depressing the vital power and inducing pyæmia. I think the nature of the cases with which we have to deal in civil practice, as exemplified in the fatal cases of primary excision at the knee and elbow which I have recorded, serves to explain the difference from the great success in primary excisions in military practice for bullet-wounds ; but whilst we cannot consider such cases as mine as favourable for excision absolutely, I believe that their chances were at least as good as, I should say better than, after primary amputation in similar circumstances, and in less complicated cases decidedly preferable even as regards the risk to life. As to the cases in which the excision was performed for disease, the two in which the fatal result is least explicable, and where I certainly anticipated success from the conditions present, are the case of the man who died forty-eight hours after the operation, apparently not rallying from the “shock.” I have given the details, but as I confess I have never been able to satisfy my own mind as to the cause of death in his case, I shall not

waste your time by attempting any explanation. The other case is that of the young woman with fimbriated disease of the synovial membrane, and ulceration of cartilages and subjacent osseous surfaces. In her case I expected, from the perfectly healthy state of the bones beyond the ulcerated surfaces, the limited nature of the disease, and its complete removal, and the absence of all marked strumous diathesis, that there was less than usual risk, but she died very rapidly from irritative fever rather than pyæmia. She was excitable and nervous, and I believe her restlessness kept up the local, and so induced the constitutional irritation. At the same time, the question suggests itself, how far the diseases of the synovial membrane are favourable for this operation? In the case of the lad who died of albuminuria, and also in the case of a female thirty-six years of age, the disease was gelatinous degeneration of the synovial membrane, which was completely and readily removed. It seems rather hard to have to count the lad's case as fatal from the excision, for I never saw a case of excision where the operation was attended with less local or general disturbance, or where the wound healed more kindly. I have, however, pointed out the tendency to amyloid degeneration of the kidney, and also to congestion of the kidneys and acute albuminuria, in cases of gelatinous disease of the synovial membrane, and therefore I fear we must look to this as one of the causes of fatal issue when we are estimating the chances of success, and in all such cases it should ever be borne in mind with reference to the after-treatment of our cases. In the case of the woman, her age, and the long continuation of the disease, were also unfavourable elements. The remaining two adult females who died after the operation, had both suffered for years from scrofulous necrosis of the shaft, which had been cured prior to the knee becoming affected.

In regard to amputation of the thigh, I shall have occasion to point out to you, as the results of my experience, that the pre-existence of necrosis to joint-disease makes a marked difference on the unfavourable results of amputation at the lower third of

the thigh, and here we find the same holds good. This, as I have said in reference to amputation, seems to me to be due to blood-taint in scrofulous necrosis, and the previous long-continued irritation and suppurations during the progress of the necrosis, so that even when the bone has separated, and the wound healed, the recurrence of the joint-disease indicates an unfavourable state of the constitution, whether for amputation or excision. Another unfavourable element in these two cases was the age of the patients, one being forty and the other forty-five years of age. In the case of the girl who died, the disease was acute cario-necrosis; and when admitted into the hospital, she was suffering from intense irritative fever. When this was subdued, the disease being limited, I considered her case suitable for excision; but I fear the state of the blood and nervous system in such cases is unfavourable for the operation, and that amputation would probably have a better chance of success. The unfavourable conditions then are—debility from disease, or originally weak constitution, advanced age—beyond forty years of age is, as a general rule, unfavourable for excisions of the knee, and the coincidence or previous existence of necrosis is also an unfavourable complication in my estimation.

In many instances of synovial degeneration, especially in cases in which, under previous treatment, partial ankylosis has been effected; and where the patient is not much exhausted, excision of the knee-joint is suitable. But I cannot consider that gelatinous degeneration is so favourable as articular caries, owing to the state of the constitution which generally accompanies the former condition. In cases of young lads or boys of pale, pasty-looking complexion, and in whom abscesses containing curdy or tubercular looking pus, have formed around the joint, I should decidedly give the preference to amputation of the thigh, as being attended with less risk to life.

The INSTRUMENTS required for performing excision of joints are—a tourniquet, to prevent bleeding during the operation; strong, sharp-pointed bistouries, for the incisions; a straight bistoury, rounded and blunt at the point, which may be useful

in some excisions, such as those at shoulder and hip; a saw with a movable back, and a blade eight inches long and three-quarters of an inch broad, the shifting back being so arranged that it is thrown off during sawing; narrow saws of different lengths (Langenbeck's) which are useful in some resections, and are more efficient than the chain saw; bone pliers of different sizes and forms; gouge, and gouge forceps; a pair Sir William Ferguson's lion forceps to grasp detached portions of bone, and give lever power; a pair small necrosis forceps; metallic spatulæ to hold aside and protect the soft tissues during section of the bones; artery forceps; suture needles, and the other instruments needed in all operations. The apparatus for after-treatment consists of cushions or pads of lint, and different forms of splints, which are chiefly needed in special resections, and will be described when speaking of these. A small quantity of solution of chloride of zinc should be at hand to touch any parts of the diseased synovial membrane, which cannot be dissected off.

LECTURE LXXXI.

Excision of Shoulder-Joint : Steps of the Operation : After-treatment—Excision of Elbow-Joint by Longitudinal, H and T Incisions—Circumstances under which one or other should be preferred—Operation—Excision of Wrist-Joint—Instruments used and Operative Procedure.

THE general principles on which excision of joints should be performed having been considered, I shall now describe the methods of performing the principal excisions or resections, commencing with those of the upper extremity.

EXCISION OF THE SHOULDER-JOINT has been very frequently performed in cases of disease of the head and tuberosities of the humerus, or for gunshot wound ; and various lines of incision have been tried to effect this resection. Mr. White of Manchester, who was amongst the first to propose this operation, used a single longitudinal incision through the central line of the deltoid. Others dissect up either a semilunar, or V-shaped flap of the deltoid, so as to expose the surface of the joint, open the capsular ligament, turn out the head of the humerus, and saw it off immediately below the tuberosities. The plan of operation, however, which I consider to be preferable to all others, as enabling the surgeon to disarticulate with greatest ease and with least loss of blood, is a longitudinal incision made over the internal aspect of the joint, which enables the operator to expose the head and tuberosities of the humerus, where they are most prominent between the coracoid and acromion processes of the scapula, then by a slight rotation of the arm outwards, to expose and render tense the broad attachment of the subscapularis into the lesser tuberosity, and to divide this easily, which may be said to be the key of the operation. Again, when in a dissection we reflect the deltoid muscle, it will be observed that the great posterior circumflex artery, which

supplies the deltoid chiefly, attaches itself to the deep surface of the posterior part of that muscle after winding round the neck of the humerus below the tuberosities ; and this large vessel being only loosely connected, would, if divided posteriorly, retract and bleed very copiously. As it passes forwards, however, entering the substance of the deltoid, it diminishes in size, and, at the anterior margin of the deltoid, only exists in the form of its ultimate muscular twigs ; it follows that both in excision and in amputation at the shoulder, we should if possible avoid division of this artery near its origin, or where it lies under the posterior portion of the deltoid.*

The operation is performed as follows :—The arm being slightly abducted, the surgeon feels for the projection of the head of the humerus immediately external to the coracoid process, and entering his bistoury just in front of the point of the acromion process, he cuts directly down upon the head of the humerus, and carries his incision deeply, downwards and slightly outwards for at least three inches and a half, or four inches. This incision should fairly divide the deltoid. On drawing aside the margins of the incision with blunt hooks, the internal and anterior aspect of the joint is seen, and the long tendon of the biceps lying in the upper part of the bicipital groove. The anterior circumflex artery is generally divided in this first incision ; and this, as well as any small muscular branches which bleed, should be secured before proceeding further. The external margin of the wound is then drawn well outwards, and if the deltoid be very powerful, or its fibres altered and condensed by disease so as not to allow it to be easily retracted with the skin, a small incision may be made across its anterior fibres immediately under the acromion. This thoroughly exposes the external tuberosity. As the arm hangs well over the table, the assistant moves the elbow slightly backwards to project the head of the humerus forward, and the surgeon, using his knife as if he were about to cut into the bone, divides at one sweep the capsular ligament and the attachments of the muscles inserted

* Plate xxxviii. Figs. 1 and 2.

into the greater tuberosity. The joint is thus largely opened, and then, by rotating the arm outwards, the tendon of the subscapular muscle attached to the lesser tuberosity of the humerus is brought fully into view, and easily divided. The arm hangs loosely, and the assistant projects the head of the humerus by drawing back the elbow (the elbow in this method of operating should not be thrown across the chest, as that buries the head of the humerus under the deltoid), so as to allow the surgeon to divide any portions of the capsular ligament which remain, and to clear the bone for sawing it below the tuberosities. In this part of the operation the edge of the bistoury should be constantly directed towards the bone, so as to avoid injury to the posterior circumflex artery, or even the great vessels; and in cases of disease, when the textures are very unyielding and the incision contracted, it is advisable to use a round blunt-pointed bistoury for this part of the operation. When the head of the bone is sufficiently cleared and projected, by the arm being drawn forcibly back and maintained firmly in that position, the operator, steadying the head of the humerus with his left hand, applies the saw and removes the diseased or injured part, taking care to remove no more than what is absolutely necessary. Any vessels which bleed are now secured, and then the state of the glenoid cavity is carefully examined. If not diseased, nothing further is required—if diseased, the carious portion may be removed with the gouge-forceps, or bone-pliers and gouge, or the whole glenoid articular surface may be clipped off with large curved bone-pliers; but this is seldom required. When there has been much suppuration in or around the joint, I usually, after the resection is completed, introduce my left forefinger into the wound and pass it downwards and backwards to the most dependent part of the cavity, and then, introducing a bistoury upon the finger, make a counter-opening of about an inch and a half in length, to allow the discharge to escape freely in that direction. A piece of perforated india-rubber tubing is passed through the wound, to keep the track open and enable us to wash out the cavity with antiseptic lotions. This plan I have

found very useful in preventing the matter collecting in the cavity of the wound when the patient is lying on his back.

When the operation is completed, the incision is united by points of interrupted suture. A long flat pad, thicker above than below, and covered with gutta percha, is placed in the axilla and between the arm and the side, the forearm and elbow supported in a sling, and the elbow fastened to the side by a circle of broad bandage. The wound is simply dressed with dry lint, except in cases where there has been much suppuration. In such cases I wash the wound with solution of chloride of zinc (1 part to 30 or 40), and use a weak tepid chlorinated soda lotion, or Condyl's fluid for dressing, for some days. At the end of four or five weeks, gentle passive movements of rotation and abduction should be cautiously begun. The general result of this operation is most successful. I have performed the operation seventeen times, and some of these cases looked very unpromising, but I have never lost a patient; while in all of them the arm left has been most useful, and in many the amount of power regained was very surprising. The patient represented in Plate xxxii. Fig. 2, seemed, prior to the operation, a very hopeless case, but his general health and muscular power have been re-established ever since the removal of the diseased parts.

EXCISION OF THE ELBOW may be effected either by means of a simple longitudinal incision, or by incisions in the form of H or $\neg$. As I have already indicated the general principles to be attended to in planning our incisions in resections of joints in the upper extremity, and in the section of muscles and tendons in these operations, in reference to the after-treatment and usefulness of the limb, I shall now limit myself to describing the steps of the operation—beginning with the operation by the longitudinal incision, which, as a general method, I prefer.

In performing this operation, the humeral artery having been commanded by the tourniquet or manual compression, the assistant, standing on the side of the patient opposite the diseased limb, grasps the arm above and below the elbow, keeping it very slightly flexed

EXCISION OF JOINTS.

Plate XXXI

Fig. 1

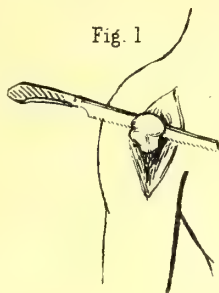


Fig. 2



Fig. 3



Fig. 4

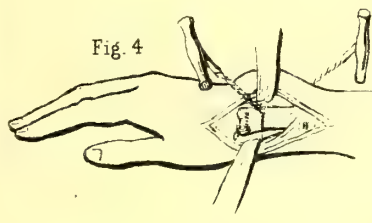


Fig. 5

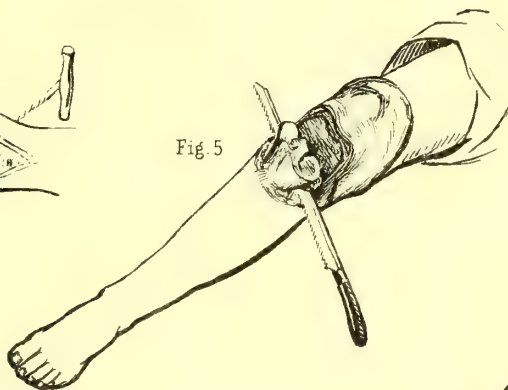


Fig. 7



Fig. 9

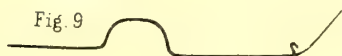
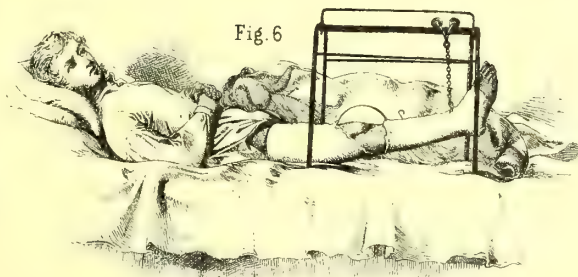
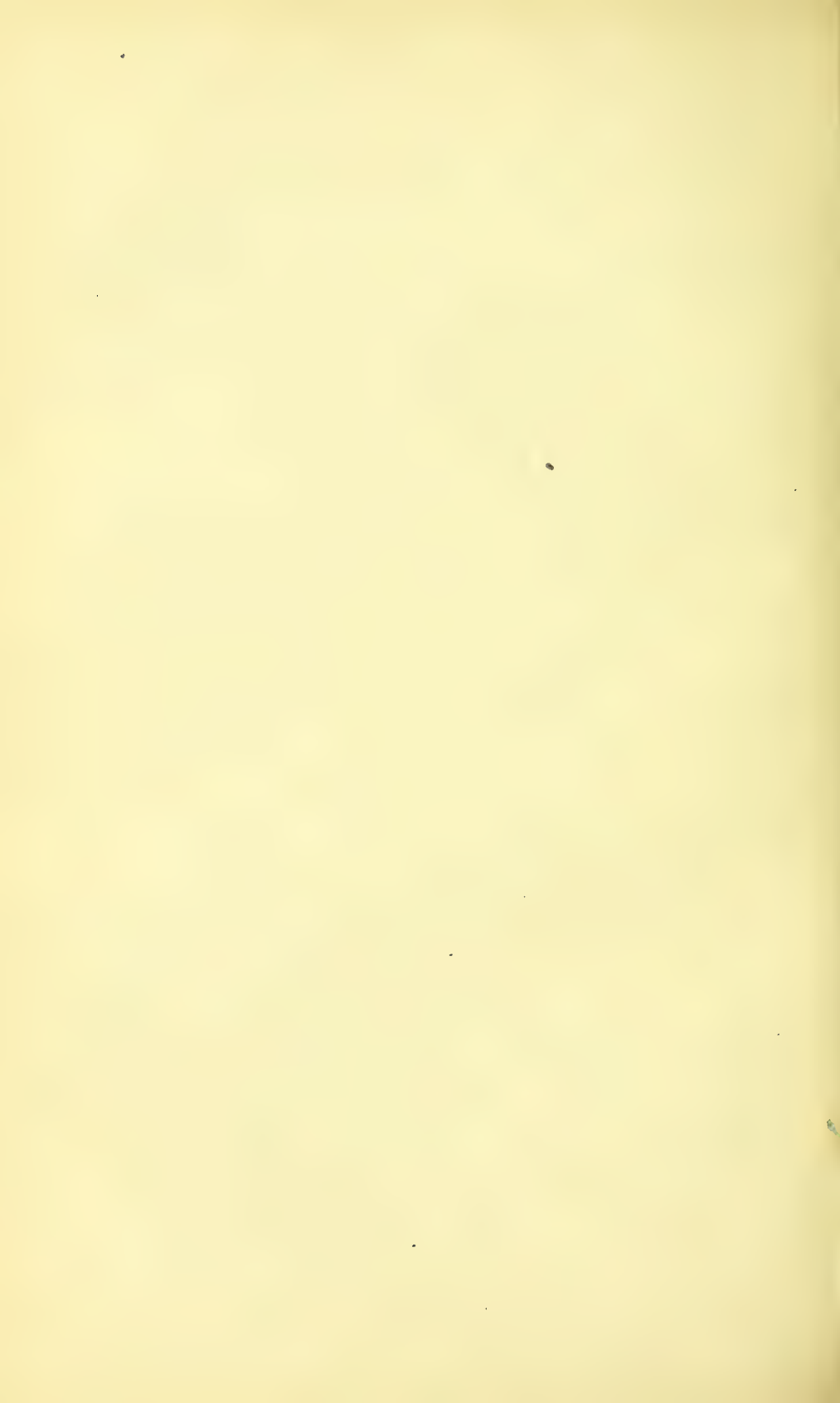


Fig. 8



Fig. 6





and raised from the body. The surgeon, standing on the same side as the diseased limb, inserts his knife in the middle line of the posterior aspect of the upper arm, about two and a half inches above the elbow, pushes it directly down to the bone, and carries it rapidly downwards, inclining the incision a little inwards as it passes over the olecranon and upper part of the ulna, and terminates the incision two or two and a half inches below the joint. He should next separate the triceps on the outer side by cutting very obliquely downwards and outwards, the edge of the knife being directed to and rasping upon the ulna, so as to separate the muscular fibres in connection with their periosteal attachment; and then this deep incision is continued downwards and outwards to separate all the textures over the outer condyle and head of the radius. This relieves the tension, and enables the operator to deal more easily with the more important step of separating the parts on the inner side of the joint. The surgeon divides the inner half of the triceps in the same manner as on the outside; but on reaching the line of the internal margin of the olecranon, the operator must recollect the proximity of the ulnar nerve, and, to avoid injuring it, must keep the edge of the knife directed towards the ulna as he cuts downwards. He then separates the parts from the humerus and ulna sufficiently to enable the textures, including the ulnar nerve, to be drawn over the internal condyle, and allow it to be fairly exposed. The assistant should now bend the arm further, to render the lateral ligaments tense, so that they may be freely divided. This is most readily effected by cutting upon or just below the condyles of the humerus, where the ligaments are narrowest, and can be divided by a single stroke of the knife. The elbow is then forcibly flexed, and the upper ends of the ulna and radius dislocated or projected backwards, exposing somewhat their anterior aspect, which may be still attached by the anterior ligament or portions of it. The operator clears the anterior aspect of the coronoid process by cutting obliquely down to and upon the bone, so as to separate the periosteal attachment of the brachialis anticus tendon from the bone, then, clearing the radius and ulna by a circular sweep of

the knife, he applies the long narrow saw, and cuts them through a few lines below the lesser sigmoid cavity of the ulna. Lastly, he clears the lower part of the humerus, and saws it off through the upper part of the olecranon fossa, and rounds off the angles of the section with the bone-pliers. All diseased synovial structure should, as far as possible, be clipped away or dissected off; and any portion which remains, or any suppurating texture, should be painted over with a solution of chloride of zinc (1 part to 30). The vessels which usually require to be secured are the branches of the inferior profunda which accompany the ulnar nerve, and the anastomotica magna on the inner side, and the radial recurrent and posterior terminal branch of the superior profunda externally; but all bleeding points must be secured by ligature, or other means, before closing the wound, which is then to be closed by an interrupted suture. The central stitches should be left untied, the wires or thread being left long so as to be tied after six or eight hours, when all oozing has ceased, and after any clots which may have formed have been removed. The dressing is simple: a long, rather thick pad, of the breadth of the limb, is placed in front of the arm, which is kept slightly flexed, then two lateral pads on either side of the wound. These pads are secured by a figure-of-8 bandage, so applied as to leave the wound free, a light veil of lint is laid over the wound, or no dressing at all to the cut surface. The limb is then laid on a pillow, and the arm secured so as to prevent the humerus being tilted outwards, which would cause the condyloid end of the bone to press upon the skin, and might lead to ulceration.

In cases where the joint is ankylosed the soft textures may be dissected off, so as to allow the removal of the articulation in a mass after resection with a fine narrow saw, or the operation may be facilitated by cutting off the olecranon with bone-pliers; and some surgeons take this latter method in all cases, but there is really no necessity for doing so generally.

Excision of the elbow by the H or $\neg$ incision is very similar as to the final steps of the operation, the chief difference being in the dissection of the parts on the posterior aspect of the joint

in the form of flaps, so as to expose the bones more fully. In either of the two plans last mentioned, the operator begins by making a transverse cut from the internal margin of the olecranon process to the articulation between the outer condyle of the humerus with the head of the radius. He next makes an incision, about three inches long, parallel to the axis of the limb, and close along the inner border of the olecranon. This completes the lines of the **T** incision. If the **H** incision is to be used, another longitudinal cut is made at the outer end of the transverse incision. In both methods the surgeon next proceeds to separate the parts between the internal incision and inner condyle; and as these contain the ulnar nerve, the edge of the knife should be kept close to the olecranon and ulna, to avoid injury to the nerve, and then the separated parts drawn inwards, and protected by a broad metallic spatula. The flaps marked out by the line of incision are dissected from the bones, the lateral ligaments divided, the ends of the bones dislocated, and projected and sawn off as described in the operation by the single longitudinal incision.

In these last methods everything depends on primary union of the transverse incision taking place, and hence the limb must be kept very quiet. Should primary union of the transverse cut fail, passive motion cannot be begun without interfering with the healing process; whilst in the longitudinal method we can begin passive motion, even though primary union should fail, without doing harm. Having performed the operation repeatedly by all three methods, I feel satisfied that the long posterior incision is preferable in many respects, and quite as easy of performance as either of the other two.

What has been said of the mode of dressing applies equally to all the methods.

EXCISION OF THE WRIST-JOINT, owing to the nature of the parts to be removed, and the necessity for avoiding the division of tendons and blood-vessels to preserve the movements of the fingers afterwards, is an operation partaking so much of the

nature of a dissection that it requires more time and patience on the part of the operator than any of the other excisions of joints. There is not, however, any special difficulty in the operation, apart from particular conditions of the diseased parts, such as the broken-up disorganised condition of the carpus, in some cases necessitating the removal of the diseased fragments, as it were, piecemeal. I have performed the operation in several cases in from ten to fifteen minutes, whilst in others I have required fully forty minutes to complete it properly.

I usually adopt, with some slight modifications, the plan described and figured in Bourguery and Jacob's *Operative Surgery*, only that, instead of the chain-saw there represented, I use a narrow saw (Langenbeck's) and the bone-pliers for the section of the bones.

The operative procedure is as follows:—A tourniquet having been applied over the brachial artery, the surgeon makes an incision from about an inch above the styloid process of the radius, along the outer and posterior aspect of that bone, over the radial side of the carpus and outer back part of the metacarpal bone of the index finger to at least an inch below its connection with the carpus. He next makes an incision on the inner and posterior aspect of the wrist, extending from an inch above the styloid process of the ulna, descending in a slightly slanting direction outwards (radiad) to a point an inch and a half below the articulation of the fifth metacarpal bone with the carpus. These incisions should only divide the skin and fascia. The operator next carefully dissects the tendons from the grooves on the posterior aspect of the radius, the skin being held aside by means of blunt hooks. The extensors of the thumb, especially the long, delicate extensor tendon of the distal joint, and the radial artery where it lies on the posterior part of the carpus, require special care for their conservation at this period of the operation. The radial extensors inserted into the metacarpal bones of the index and middle finger need not be preserved, as their points of attachment usually require to be removed in the resection of the diseased parts. The tendons of the common

extensor, and of that of the little finger, are then cleared from the inner part of the radius and groove on the back of the ulna, the edges of the inner incision being held apart to enable the surgeon to do so carefully. In clearing these last-mentioned tendons from the back of the carpus and metacarpus, I direct the assistant who has charge of the hand to bend it backwards to relax the tendons, and then insert my knife under the tendons, where I have cleared them above the wrist, turning the edge of the knife towards the bones, I cut downwards so as to clear the tendons and fibrous textures from the surface of the carpus and metacarpus to the required extent, without risk of division of the tendons. The next step in the operation is to separate the flexor tendons lying in front ; and, from their comparatively loose connections, this is readily accomplished by dissecting close in front of the radius and ulna at the outer and inner incisions, and then with the finger, aided by a few touches of the bistoury, the finger or handle of the knife can be passed between the tendons and the bones, whilst the hand is bent forwards to relax the textures. This having been effected, I pass a double fold of broad bandage between the bones and the soft parts on the back of the wrist, to draw them away and protect them during the section of the bones. I then introduce a straight grooved director (a large straight female lithotomy-staff answers the purpose) between the flexor tendons and the front of the radius and ulna ; along its groove the narrow saw is introduced, and the bones sawn through just above their styloid processes from before backwards, or, if more convenient, the director or a narrow metallic spatula being placed so as to protect the flexor tendons, the section of the bones may be proceeded with from behind forwards. The saw is next applied to the metacarpal bones of the fingers, immediately below their junction with the carpus. In some cases I clear the soft texture from the front of the bones, and then pass the narrow saw across the hand, its cutting edge directed to the metacarpus, and saw them through from before backwards. If an attempt be now made to dissect out the mass thus resected, it will almost certainly fail, or

require a tedious and not very safe dissection ; but if the mass of the carpus and metacarpus be subdivided into smaller portions, each of these can be removed easily and safely. Accordingly, after having sawn through the metacarpal bones of the fingers, I use the bone-pliers and cut the carpus upwards between the index-finger and thumb ; and again, in the same manner, in the line between ring and middle finger. I then seize the portions so marked out with a pair of strong forceps or hook to obtain leverage, and cautiously dissect the bones from the textures in front. The two internal portions having been removed, it merely remains to deal with the external third of the carpus. If the trapezium appears so far sound that I can leave it or its articulating surface with the thumb, I do so, as the usefulness of the hand is thereby much preserved. If not, then I snip off the articular end of the metacarpal bone, and remove that and the remaining portion of the carpus, and also the ends of the ulna and radius if not previously removed. I also leave the pisiform bone when not diseased, as the attachment of the ulnar flexor is thereby preserved. The resection being thus completed, the tourniquet is relaxed, and all bleeding points secured ; special care should be taken to secure small vessels deeply seated in the palmar region, as they may prove troublesome afterwards by distending the wound. I generally introduce the points of suture without closing them for some hours till all oozing has ceased. The hand and forearm are then placed on a splint so padded as to allow the hand to rest comfortably. Subsequently it is placed on a special splint fitted to the hand ; the splint should be hinged at the wrist, so that after a time passive motion may be used. Of late, instead of bandaging the hand, I fix it with broad strips of adhesive plaster.

LECTURE LXXXII.

Excision of Hip-Joint : Objections to the Operation : Mode of performing it when required—Excision of Knee-Joint by Longitudinal, Transverse, and Semilunar Incisions : Operation : Rules for the Permanent Adjustment and After-treatment of the Limb : Dr. Watson's Apparatus—Excision of the Ankle-Joint : Best Method of performing it.

EXCISION OF THE HIP-JOINT.—I have already expressed my objection to this operation, except in cases of advanced morbus coxarius, in which the parts are attenuated, and where the articular structures are disorganised, and the diseased head and neck of the femur are lying almost loose or partially lax in the cavity of an abscess, or are to be felt through openings from which pus has been discharged. In such cases, by freely laying open the sinuses over or along the posterior aspect of the great trochanter, and extending the incision upwards and downwards, and curving its extremities slightly forwards, or by converting the longitudinal into a crucial incision, by making a short transverse cut across it a little above the great trochanter, and dissecting the flaps from off the bone, the trochanter and upper part of the femur are exposed. The limb is then carried obliquely across the opposite one, so as to render the trochanter prominent. A bold firm sweep of the knife carried from the anterior to the posterior part of the trochanter upon its upper edge, and downwards along the femur for two or three inches, separates the attachments of the gluteal muscles. When these are detached, the surgeon, by carrying the limb still more across the opposite one, and twisting it, will often be able at once to project and dislocate the diseased portion of the bone, so as to enable him to apply the saw and remove the trochanter and head and neck of the femur. If, however, the capsular ligament still exists, so as to require division, the operator should introduce his finger into

the wound, whilst an assistant uses the thigh as a lever to project and twist outwards the head of the femur, and render the capsule tense over it. Insinuating his finger between the upper part of the capsule and the soft parts in front of it, he should introduce the blunt-pointed knife, guarded by his finger, and turning its edge towards the capsule cut directly down upon the projected head of the femur. This will open the capsule, and then the head of the femur will be readily turned out, for the round ligament is usually destroyed by disease; if not, it can now be easily divided, and the section of the bone performed. Any vessels which may bleed are then secured, the acetabulum examined, and the gouge applied to remove all disease that can be removed with safety or without perforating into the pelvis. When all oozing has ceased, the wound is closed by sutures, and the limb either laid on padded wire-splint, kept straight by means of the bracketed long-splint, or the extension pulleys, as in fracture of the thigh; only we must avoid much extension, as our object is merely to keep the limb straight and not to keep it of the full length of the opposite, but rather to afford every facility for osseous or firm fibrous ankylosis at the hip taking place.

EXCISION OF THE KNEE-JOINT has been performed by various methods—1st, The **H** incision—two lateral incisions over the outer and inner sides of the joint, connected by a transverse incision in front across the patella. 2d, A single longitudinal incision in the axis of the limb, commencing about two and a half or three inches above the patella, and carried down over the centre of the joint to below the insertion of the ligamentum patellæ; the textures being dissected off laterally to expose the joint, allow the ligaments to be divided and the articular ends of the bones to be sawn off. Lastly, A gently-curved incision from one condyle of the femur to the other, passing below the patella, the convexity of the curve corresponding nearly to the upper margin of the head of the tibia; the semilunar flap, so marked out on being dissected up, freely exposing the

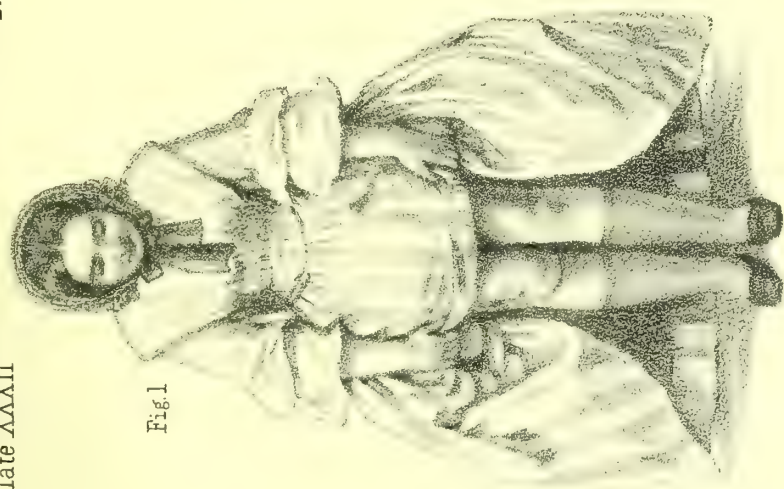


Fig. 1

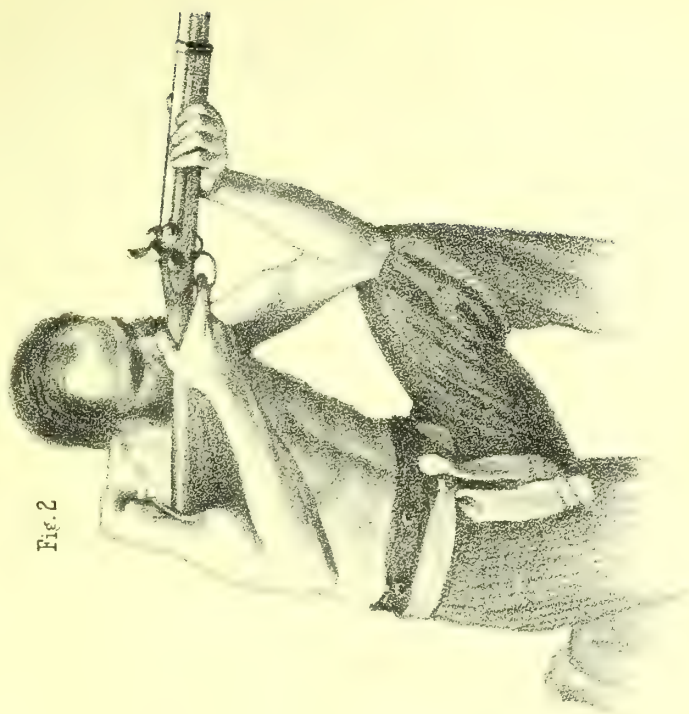


Fig. 2

articulation for the further steps of the operation. Of these methods, I prefer the last, and it is that which is now almost uniformly adopted in this country. The dissection of flaps and exposure of the textures involved in the method of the *H* incision are unnecessary, and even hurtful. The longitudinal incision, which I consider the most advantageous in the case of the elbow, has no advantage here, as we do not desire a movable articulation, whilst its form and position favour the retention of blood and serous or purulent discharge in the cavity of the wound.

I shall therefore describe and show you the operation by the lunated incision as I usually perform it. The tourniquet having been applied over the femoral artery, the leg of the affected limb is to be supported by an assistant, seated in front of the patient, the knee being very slightly bent. If the right knee is to be operated on, standing on the inside of the limb I commence my incision over the posterior margin of the outer condyle of the femur, and carry it down to the upper margin of the head of the tibia; then sweep across the front of the joint at that level, curving my incision upwards over the inner condyle of the femur to a point opposite that where I commenced. If the case be one of articular caries or ulceration of the cartilages, I carry my incision so deep as at once to divide the ligamentum patellæ and anterior part of the joint, and then divide the lateral ligaments; the semilunar flap, including the patella, is drawn upwards, and the condyles of the femur and tibia separated by bending the knee, so as to expose and facilitate the division of the crucial ligaments. The section of these ligaments should be made by cutting them upon the crest of the tibia, to which they are attached inferiorly, as, by doing so, we avoid risk of injury to the popliteal vessels, which might be injured if we used the knife carelessly at this stage of the operation, especially when the surrounding textures are much altered and disorganised. When the crucial and lateral ligaments are fairly divided, by elevating the femur, its condyles can be projected sufficiently to enable the operator to saw off

as much of the bone as is required. The assistant who supports the leg is desired to project the head of the tibia a little by carrying the foot backwards. The condyloid surface of the tibia is then cleared above the articulation with the fibula. The narrow saw is applied so as to remove a thin slice of the articular surface by sawing from behind forwards. The sharp projecting portions of the section of the femoral condyles are then sawn off or removed with the bone-pliers. The surgeon now applies the sections of the tibia and femur to each other, to see whether their surfaces fit accurately, and examines them to see that all diseased texture is removed. If the patella be diseased it must be dissected off, but if not diseased it should be left. In cases of synovial disease the procedure is somewhat different. The semilunar incision should only divide the skin, fat, and fascia, and be reflected as a flap from the synovial swelling. The whole of the projecting diseased mass, including the patella, is then dissected off from above downwards, and from the sides. Thus the greatest portion of the diseased synovial structure is at once got rid of, and the joint fairly exposed; the lateral and crucial ligaments are then divided, and the other steps of the operation completed as already described. All portions of diseased synovial structure that can be safely dissected off should be removed, and the rest of the surface painted over with the chloride of zinc solution. In excision of the knee, after all the bleeding points had been secured, it used to be the practice to close the wound and put up the limb in the splint. But there is often troublesome oozing from the bone and from small vessels which do not bleed at the time of the operation, and hence I prefer merely to insert some points of suture without tying them, and to place the limb upon a temporary splint. If reactionary bleeding occur, the wound should be re-opened, and permanent adjustment of the limb delayed until twelve, or even twenty-four, hours after the operation. When the bleeding from the section of the bone is very troublesome, I have sometimes found it necessary to interpose a flat pad of lint soaked in a solution of perchloride of iron between the femur and tibia, to

arrest the hæmorrhage. This has usually been quite effectual, the cases going on favourably afterwards.

The permanent adjustment and after-treatment of the limb require great care, with a view to which the selection of proper apparatus is important. In my earlier cases I used to employ the form of splint advised by the late Mr. Price, and the limb was kept fixed, the apparatus resting on the bed. Though the results of these cases were admirable, the treatment was very troublesome; and I feel convinced that for comfort to the patient, and for obtaining a good result with greatest ease, the apparatus should always be swung so that the movements of the trunk may not injuriously affect the limb. Thus the patient can, after a few days, sit up in bed, and bed-sores are prevented. Price's splint is sometimes useful where we want counter-pressure on the sole of the foot, to maintain the tibia in firm contact with the femur in cases where the osseous union is slow in forming.

But, as a general method, I prefer and use, with some slight modifications, the simple and effective apparatus designed by my colleague Dr. Watson. "It consists essentially of two parts—1. A suspension-rod made of iron, about the size of No. V. of trade wire gauge; 2. A modelled Gooch splint, long enough to extend from the tuberosity of the ischium to beyond the heel.

"*The suspension-rod* extends from the groin to the extremities of the toes, and is bent to the outline of the limb, departing from it only in the situation of the excision, where it forms a bow or arch. To the upper surface of the rod are attached one or more hooks by which the suspension is effected."

"*The Gooch splint* should not be made too wide, and should certainly not surround the thigh and leg to more than two-thirds of their circumference. It should be scooped away laterally, at a part corresponding to the site of the excision, and should have an aperture cut corresponding to the tendo Achillis and heel. The inferior extremity of the splint is thus of a horse-shoe or stirrup shape, and admits of the ankle and foot being supported by the lateral horns of the splint, as they fold on each side of the malleoli, without the risk of inordinate

pressure being made upon the tuberosity of the os calcis. In application, the limb is first laid and carefully adjusted upon the posterior splint, which should preliminarily be padded with lint, and covered with gutta-percha tissue, or hot paraffine, in the situation which corresponds to the site of operation. The iron rod is then placed in front, and folded lint laid between it and the limb at the groin (where the rod terminates above), at the upper part of the tibia, and at the bend of the ankle. These two parts of the apparatus are then retained in contact with the limb by means of an *open-wove* roller bandage applied from the toes upwards, the site of the incision alone being left uncovered. The whole is then rendered immovable by means either of plaster-of-Paris applied by the hand, of a consistence like thick cream, or of paraffine, which, having been rendered temporarily liquid by heat, is applied by a large painter's brush. When the application has solidified, the patient may then be removed to bed, and the limb suspended from the running pulley of a Salter's swinging cradle, or from the roof-bar of the common iron-wire cradle employed to support the weight of the bed-clothes. The foot and limb should not be much raised above the level of the mattress upon which the patient lies, as this is apt to lead to an awkward position of the limb when the patient first begins to move about."

In my own practice I omit the use of the plaster-of-Paris, or at least only use it at certain parts to give firmness and solidity to those points from which the apparatus is to be slung. I substitute broad strips of adhesive plaster in interrupted circles, to fix the apparatus to the foot, leg, and thigh, and then apply an ordinary roller round the foot and leg to a little above middle of the calf, and apply another roller from about four inches above the knee up to near the hip. The pelvic part of the splint is fixed with broad strips of plaster. If there be any tendency to projection or elevation of the condyloid end of the femur, a flat pad should be placed in front, and a separate circle of plaster or broad bandage applied over it and fixed behind the splint. My objection to the plaster-of-Paris bandage

is, that we cannot readily ascertain when deep-seated abscesses may be forming. In three cases in which I used it, everything looked well at and near the wound ; the patients complained of no pain, and it was only after discharge showed itself at the upper part of the apparatus, that abscess, burrowing under the muscles of the thigh, was detected. The modification I recommend allows of the bandage being cut or removed without disturbing the limb, as the broad circles of adhesive plaster retain the apparatus fixed until a clean bandage is applied. Besides, as swelling subsides, the gypsum bandage is liable to become loose and permit of motion between the ends of the bones. I would also advise a water instead of an air pillow as being more comfortable ; but that is a matter of minor importance.

EXCISION OF THE ANKLE-JOINT.—This operation, which corresponds to excision of the wrist in the upper extremity, is, however, much less complicated and much more easily and rapidly performed. The bones which enter into the formation of the joint, are only the lower extremities of the tibia and fibula, and upper head of the astragalus, which last is so defined that its resection can be accomplished without interfering either with the astragalo-scaphoid or calcaneo-astragaloid articulations ; whilst, as regards the tendons and blood-vessels, they are so arranged, and so loosely connected with the bones and joint in front and behind, as to be readily separated and drawn aside, to permit of resection being effected. My own experience of the operation is limited to cases of compound dislocations, in which I consider its performance is preferable to merely reducing the dislocation ; and the ease with which the resection can in these instances be performed proves that in certain cases of disease it might be as easily effected with great advantage. But, unfortunately, the suitable cases are of rare occurrence, as the extent of the disease, and the implication of the surrounding textures, are very generally such as to necessitate amputation.

The best method of performing excision of the ankle is by means of two lateral incisions ; one along the inner and posterior

margin of the tibia, commencing about two or two and a half inches above the internal malleolus, and passing below the malleolus, curving round it and forwards towards the inner margin of the tendon of the *tibialis anticus*. The other incision is of the same extent and form, along the outer margin of the fibula, and should curve to the *peroneus tertius* tendon on the outside of the foot. The operator first carefully dissects or separates the tendons of the *peronei* muscles from the fibula, till he can pass his finger well behind that bone. He then proceeds to separate the *tibialis posticus* and common flexor from the tibia along the line of the internal incision, and carefully clears the posterior aspect of the tibia and fibula above the joint, so that he can pass a narrow metallic spatula from one incision to the other, between the bones and the soft parts placed posteriorly. The next step in the operation is to dissect forward the skin flaps marked out by the incisions, and separate the tendons, vessels, and other soft parts in front from the joint. In doing this, the edge of the knife should be constantly directed towards bones and joint, to secure the safety of the extensor tendons and anterior tibial artery, and also to disturb the connection of parts as little as possible. When this has been accomplished, a doubled fold of broad bandage is passed behind the soft parts, to enable the assistant to draw them forwards. The foot should now be forcibly inverted, to put the external lateral ligament on the stretch and render the external malleolus prominent: by cutting directly upon the point of the malleolus, from without inwards, the narrow attachment of the external lateral ligament is at once divided. Then, the margins of the inner incision being separated, the surgeon divides the narrow attachment of the internal lateral ligament on the point of the internal malleolus. The joint being thus opened, the foot is replaced, and held firmly at right angles to the bones of the leg. The soft parts are then held forcibly apart from the bones; the long narrow *Langenbeck* saw is passed between the posterior surface of the bones of the leg and the soft parts, which are protected by the metallic spatula; and the tibia and fibula sawn through from behind forwards,

about an inch above the malleoli. As the malleolar fragments have already been separated from their ligamentous attachments, a few touches with the point of the knife suffice to separate any remaining attachments, and the resected fragments are removed, either by the internal or external incision. As the soft parts are held apart, and the foot fixed, the upper portion of the astragalus comes into view, and the projecting articular portion is sawn off. Should there be any difficulty in doing this, the foot should be twisted, so as to project the astragalus laterally, to allow the section to be made with the narrow saw. All portions of diseased or injured synovial structure should be removed, all bleeding vessels twisted or otherwise secured, and points of suture introduced, and either closed at the time or left to be secured when all oozing has ceased.

When there is much diseased synovial tissue, which cannot be dissected off, the surgeon should paint it over with a solution of chloride of zinc (1 part to 30). The limb is then placed on a light wire-splint, well padded and covered with gutta-percha tissue, secured and slung in the same manner as for compound fracture of the ankle, represented in Plate xvii. Fig. 13, only, instead of bandages, broad strips of adhesive or soap plaster may be advantageously used to secure the limb to the splint, and the use of ice-bags must depend on the circumstances of each case.

LECTURE LXXXIII.

Amputation : Ends sought to be attained by it : Best Modes of fulfilling these—

Anatomy of Stumps—Growth of Bone after Amputation—Advantages and Disadvantages of various Forms of Flaps, as advocated by Liston, Syme, and others.

THERE are few operations which the surgeon is more frequently called on to perform than AMPUTATION, and none which require more consideration as to the best methods of operating, more care in the performance, and more attention in the after-treatment. Whilst, on the one hand, the term “Opprobrium of Surgery,” is singularly unsuitable as applied to an operation, which, by removing a disorganised or worse than useless part, so often snatches the patient from the very jaws of death, and restores him to health and comparative enjoyment ; on the other hand, as it is an operation which necessarily entails mutilation, the surgeon is bound to use his utmost endeavours, not only to obviate the causes of danger to life, but also to avoid those conditions which are likely to interfere with the future comfort of the patient. He must not only remove the limb with safety to the patient, but he must also avoid the production of a painful or irritable stump.

The formation of a good useful stump, effected with the least risk to life, being the object in view, the question to be decided is, What methods of operating enable us most surely and readily to attain it ? Having had a very considerable experience in performing amputations, and having, from an early period of my professional life, paid great attention to the subject, I trust the following remarks, founded on the results of my personal investigations and experience with regard to the different modes of operating, may be of some practical service.

In deciding on the advantages or disadvantages of the differ-

ent plans of operating, we must first determine what are the requisites of a "good stump." I believe these may be succinctly stated thus : that the bone be well covered with soft parts ; that it shall not be adherent to, nor bear directly upon, the cicatrix ; that the nerves be so cut as not to become involved in the cicatrix or attached to the end of the bone ; and that they be so deeply covered as to obviate the bad effects produced on their cut extremities by pressure or atmospheric changes. A stump possessing these requisites will be able to bear a considerable amount of direct pressure, without becoming painful, irritable, or liable to ulceration.

Having fixed a standard, I now proceed to consider how far the various methods of amputation reach or fall short of it, and what is the best mode of attaining it. In considering the general principles I shall take the amputation of the lower extremity, and specially that of the lower third of the thigh, as typical of the operation.

When I first entered the profession, the methods of amputation then in general use were, the flap operation by transfixion, and the old circular operation as modified by Alanson. In Edinburgh the former method, characterised by great rapidity in its performance, and strongly advocated by Messrs. Liston and Syme, had so completely gained the ascendancy that I never saw the circular operation performed until I visited the hospitals of London and Paris. There I found most of the leading surgeons keen advocates for its employment, and denouncing the flap operation as being much more dangerous to life, and as leading ultimately to bad stumps. My own observations, tinged perhaps by some prejudices of education, led me to the conclusion that the flap method was decidedly the better ; although a careful examination of results showed me that it did not possess all the advantages claimed for it. The chief objections I had heard urged against the flap operation by the advocates of the circular method, were first, that the redundancy of muscular tissue retained acted as a source of danger ; secondly, that this tissue was useless as a covering, because it became atrophied, and in

course of time disappeared altogether ; and thirdly, that the manner in which the nerves were cut favoured the development of neuromata. With regard to the first of these objections, subsequent experience has shown me that it possesses much force. In order to determine how far the two latter assertions were correct, I made a series of dissections, which included stumps formed by both methods of amputation. Several of these dissections are now in the University Museum, and others in my private collection. As the result of this investigation, I may state, without entering into details, that, whilst the muscular substance retained in flap operations was observed to be diminished in bulk, the decrease in many cases had not occurred at all to the extent which *à priori* reasoning might lead us to expect. Thus, in a flap amputation of the leg, which I dissected twelve years after the operation, the portion of the gastrocnemius covering the end of the bone had scarcely undergone any change ; and in a dissection of a hip-joint stump, three years after the operation, the coarse muscular fasciculi of the gluteus were distinct and of natural appearance up to the very cicatrix ; and in almost every case, the muscular tissue, even when greatly altered in character, could still be traced as a thick fibrous layer under the integument. As regards the presence of neuromata, or enlargements on the extremities of the divided nerves, I found that these were equally present in all forms of stumps, and even when the nerves were deeply covered ; that, in fact, a greater or less enlargement of the end of a nerve was a necessary consequence of its division. From a careful examination, with low magnifying powers, of such neuromata in dissected stumps, and of those which I had removed from stumps in the living, I found that they consisted of consolidated lymph, deposited amongst the fibrillæ of the nerve ; and, as explanatory of their origin, I think it probable, as I stated in a notice of this subject before the Anatomical Society of Edinburgh, that when a nerve is divided the neurilemma retracts to a greater extent than the contained fibrillæ, which, being thus set at liberty, spread out and separate from each other ; that lymph is then effused in the spaces between

AMPUTATIONS.



Fig. 1

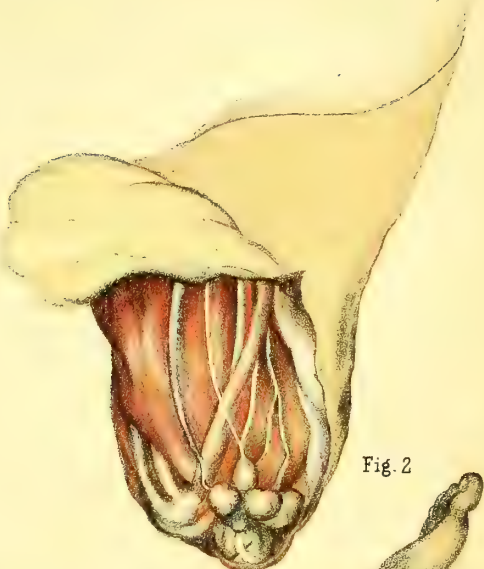


Fig. 2



Fig. 5

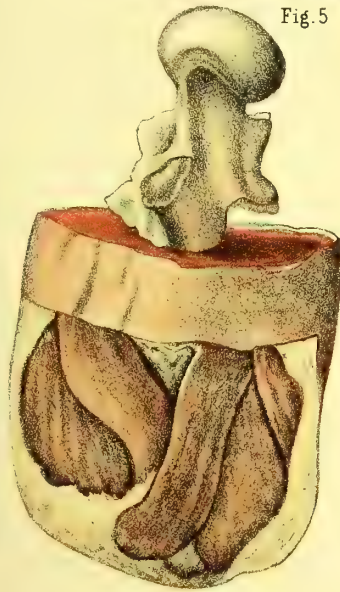


Fig. 3

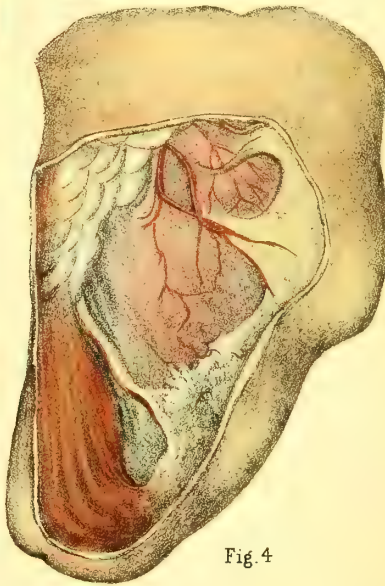


Fig. 4



them, and that the nerve filaments become attached to this lymph, and, as further effusion takes place, are stretched out upon it. When such swellings are subjected to irritation from pressure, or, being near the surface and scantily covered, are liable to atmospheric influence, or when they happen to have become involved in the cicatrix, they increase in size, and give origin to excessively painful symptoms ; but, whether the stump has been a painful one or not, neuromata are invariably present on all the nerves of any size.

I may here also describe the appearances observed in the bones forming the skeleton of the stumps. At the point where they were sawn across, the surface had become rounded off, and the medullary canal was closed in by the effusion of new bone. They were also, in most cases, atrophied so as to appear more than naturally pointed ; but in some instances they were enlarged, either generally or partially, by the deposition of osseous matter. In stumps of the forearm and leg the ends of the two bones were usually approximated and connected by a strong ligamentous substance, and in some cases they had even coalesced so as to form an osseous arch. In almost every instance the end of the bone corresponded to the cicatrix, and was often firmly united to it.

There is an interesting point in connection with this part of the subject, to which I would further allude—namely, the growth of the bone after amputation in young persons, this growth giving rise to projection of the cicatrix and conical stump. Mr. Hargrave of Dublin long ago drew attention to this circumstance in his work on operative surgery ; and my own observation leads me to believe that the bone may continue to grow in the young, and thereby tend to produce the results which have been mentioned, although, doubtless, this condition of stump may also be caused by other circumstances which come into play as the patient grows up. My own dissections do not furnish sufficient data on this point, but I have one preparation of so marked a kind that I cannot but refer to it. The case was one of amputation of the upper arm, performed by Mr. Liston ; and in it not

only does the bone project in an extreme degree, but it terminates in a hook-like process. This could scarcely result merely from the retraction of the other tissues. The practical deduction to which this leads us is, that in performing amputation on the young we should leave rather a redundancy of soft parts, so as to obviate the effects of the osseous development.

These dissections, then, satisfied me, in the first place, that the muscular tissue preserved in stumps formed by the flap operation was useful in providing a thick layer or protecting pad, which did not disappear even after the lapse of many years; and, in the second place, that a certain degree of enlargement of the ends of the nerves in a stump was the inevitable consequence of their division, in whatever manner the operation was performed; the point to be attended to in regard to this being to cut them so high that they could not become involved in the cicatrix, or stretched over or adherent to the end of the bone, and to have them so deeply covered as to be less liable to be affected by atmospheric changes or external pressure.

I was still further induced to give the preference to the flap operation by the condition in which I found those stumps that had been formed by the circular method. Nearly all of them that I examined were extremely conical, and had the bone adherent to the cicatrix, which latter was not unfrequently ulcerated; in the living subject, too, they were almost always excessively tender. At the same time, many of the stumps formed by the flap operation were very defective, and this was especially the case when the amputation had been performed according to the method of Vermale, by lateral flaps in the lower third of the thigh. In such a stump the bone projected towards, and generally adhered to, the cicatrix at the anterior point of transfixion, whilst the soft parts forming the flaps hung back from it. In many cases both of lateral and antero-posterior flap operation I found the soft parts so retracted as closely to resemble stumps formed by the circular method, and in several the bone projected the cicatrix, whilst in others the flaps seemed to have turned in upon themselves, leaving a deep cleft corresponding to

the cicatrix, which was closely attached to the bone. Still, as a general rule, the stumps resulting from the flap operation were decidedly better than those from the circular, and their defects apparently did not depend on causes inherent in the mode of operating; and, on the whole, this method appeared to combine greater rapidity and facility of execution, with the formation of a more thickly-covered stump.

The plan which I adopted in my earlier operations was that by anterior and posterior flaps as recommended by Mr. Liston. The flaps were made by transfixion, the one in front being rather short, whilst the one behind was considerably longer, in order to allow for the greater retraction of the posterior muscles. The flaps were then pulled well back, and the bone cleared by circular sweeps of the knife before applying the saw. Thus, when the operation was concluded, the result was two rounded flaps of equal length, with the bone cut through a little higher up than their bases. Nothing can look finer than this at the time. The smoothly-cut flaps come neatly together, and cover the bone thickly, so as to form a well-rounded stump. Practical experience, however, soon showed me that in order to obtain a permanently well-covered stump, it would not do to trust to flaps formed in this manner, as they had a tendency to retract gradually to the point of transfixion; and if, in order to remedy this defect, they were cut very long, they contracted and turned in upon themselves, and left a deep cleft in the line of the cicatrix, so that the cushion of soft parts did not correspond to or cover the end of the bone. Seeing, then, that merely adding to the length of the flaps did not produce the result which was desired, I was led to make an alteration in the method of operating itself. I transfixed the limb fully two inches lower down than where I intended sawing through the bone, and having cut and retracted the flaps, I applied the point of the knife round the bone so as to clear it upwards to the extent of the two inches already specified. The limb was now raised in order to project the bone away from the soft parts, and the saw was then applied as high as possible. By this means the bone remained deeply covered even

after permanent contraction of the stump had taken place, because, although flaps may retract up to the line of their bases, they cannot do so beyond it, and by such a mode of amputating as has been described the bone was cut through a long way above the base of the flaps.

I still further modified my plan of operating by making the anterior flap the longer of the two, instead of the posterior as recommended by Mr. Liston. That great surgeon, when speaking of antero-posterior flaps in the thigh, urges, as one of their advantages, that "the more the stump is raised, the better is the end of the bone covered—the anterior flap folds over it." Examination, however, has shown me that, in stumps formed according to Mr. Liston's method, the bone is never fully covered by the anterior flap; and indeed it will be obvious to any one, that the mode of balancing the flaps by cutting the posterior longer, so as to allow for its greater retraction, must necessarily make the line of cicatrix pass through the centre of the end of the stump, and so correspond to the extremity of the bone. By cutting the anterior flap, however, rather longer than the posterior, two unequal flaps will result; the anterior will then "fold over the end of the bone," and the cicatrix will be posterior to the centre of the stump. Another advantage which arises from this plan of operating is, the greater simplicity of the dressing and after-treatment, owing to the diminution in the bulk and weight of the posterior flap. I continued to practise the double-flap operation thus modified, and to teach it in my surgical lectures up to a very recent period; and from the results I obtained I was satisfied that it did not leave much to be desired as regarded the form of stump; and in some parts of the limbs, and under certain circumstances, it is that which I still recommend and adopt. It, however, requires great care in its performance, and in some cases is attended with much difficulty. As examples of such cases, I may especially refer to two of not uncommon occurrence—namely, primary amputations, and amputations through condensed textures, as in the vicinity of necrosed bones. In the former, when amputation is performed on a healthy man it is almost

impossible to avoid a redundancy of muscular tissue, and this not only prevents the integuments coming readily together, but also causes the section of the bone high up to be a matter of great difficulty. In the latter the densely consolidated, almost cartilaginous, tissues composing the flaps, cannot be retracted so as to allow the bone to be cleared and sawn through sufficiently far above the point of transfixion, and therefore, in such cases, this plan of operating cannot be properly executed. To get rid of the redundant muscle in primary amputations, and more especially in amputations below the knee, I used to slice off a portion of the muscle after the flap was formed ; and this, although a somewhat awkward-looking procedure, made a better stump.

In 1846, Mr. Syme, whose writings and practice had done so much to introduce and promote flap amputation in this country, took occasion to state, in a paper on amputation of the thigh (*Edinburgh Monthly Journal of Medical Science*, 1846), that his experience had led him to modify his opinion as to the advantages of flap amputation, and to recommend as preferable, in the lower third of the thigh, a modification of the circular method. This consisted in making two semilunar incisions through the integuments, which are dissected and retracted upwards for at least two inches, then cutting the muscles on a level with the retracted skin obliquely up towards the bone, the muscles on the posterior aspect being divided somewhat lower down than those on the anterior. All the soft textures are then forcibly retracted, and the bone cleared and sawn high up. This plan of operation, when it is well performed, and when care is taken to leave a sufficiency of soft parts, gives excellent results, and is especially applicable to primary amputations. I have repeatedly operated by this method in such cases, and also in others ; and although at first prejudiced against it, I have no hesitation in saying, that in primary cases at least it is superior to the ordinary double-flap operation by transfixion, both as involving less risk to life, and as forming a better stump. In several cases, also, I have practised the ordinary circular amputation with the same successful results. But whilst I was thus

led to recognise the advantages of the circular, or modified circular, method in primary and certain other amputations, yet in ordinary cases of disease of the knee, where the muscular tissue was not redundant, I continued to practise the modified double-flap operation formerly described, because where the circular method was employed, the muscles, owing to the way in which they were divided, retracted and did not heal over the end of the bone. The only covering for the stump, therefore, was the skin and subcutaneous fatty layer, which latter, in cases of chronic disease, is apt to be very scanty. Mr. Syme, indeed, supposes that there is a mistake in regard to preserving muscular tissue, and thinks that skin is the proper covering for a stump. In the paper already referred to he says—"The perfect condition of stump resulting from amputation at the ankle, where there is nothing but integument to protect the bone, led me to conclude, that if the circular operation could be performed with the certainty of producing such a covering, it might be employed with advantage in the lower third of the thigh, which being the thinnest part of the limb, more readily admits of forming a stump composed merely of skin." There is, however, a fallacy in this, arising from the idea that in the ankle-amputation there is nothing but integument to protect the bone. The protective covering in that amputation is altogether peculiar, consisting as it does not merely of skin and ordinary subcutaneous fat, but of a peculiar elastic cushion of fat and fibrous tissue, specially arranged and adapted by nature for bearing direct pressure. If indeed we could, as Mr. Syme observes, obtain such a covering in other situations, it would undoubtedly be superior to all others; but unfortunately, in no other amputation can we obtain it; and as the dissections of old stumps have shown me that the muscular tissue retained does form a protective covering more or less thick, I still think that if we can preserve it in moderate amount, and in such a position as fairly to cover the end of the bone, we shall then have a better stump than when we trust entirely to skin.



LECTURE LXXXIV.

Amputation *continued*—Mr. Teale's Method, by a Long Anterior and Short Posterior Flap: its Advantages and Disadvantages—The Author's Method, by Long Anterior Flap—Mr. Carden's Method.

IN 1858 the late Mr. Teale of Leeds published an account of his method of amputation by a long and a short rectangular flap. The mode of performing the operation, and the objects proposed to be attained, may be given in Mr. Teale's own words. "To procure a more useful stump, and in the hope of somewhat diminishing the mortality of the operation, it is proposed to amputate by a long and a short rectangular flap; the long flap, folding over the end of the bone, being formed of parts generally devoid of large blood-vessels and nerves, whilst these important structures are contained in the short flap.

"The size of the long flap is determined by the circumference of the limb at the place of amputation, its length and its breadth being each equal to half the circumference. The long flap is therefore a perfect square, and is long enough to fall easily over the end of the bone. In selecting the structures for its formation, such parts must be taken as do not contain the larger blood-vessels and nerves. A flap so formed will be, for the most part, anterior in position, as far as regards the general aspect of the body, but superior when the patient is in the recumbent position, as during the after-treatment. The short flap, containing the chief vessels and nerves, is in length one-fourth of the other. The flaps being formed, the bone sawn, and the arteries tied, the long flap is folded over the end of the bone; each of its free angles is then fixed by suture to the corresponding free angle of the short flap. One or two more sutures complete the transverse line of union of the flaps. At each side the short flap is united to the corresponding portion of the long one by a

point of suture, and one suture more unites the reflected portion of the long flap to its unreflected portion. Thus the transverse line of union is bounded at each end by a short lateral line at right angles to it."

Before investigating the merits of this method, we may observe that amputation by a long anterior and a short posterior flap is not a new operation. In 1765 Mr. O'Halloran of Limerick recommended, and carefully described, such a method for amputation of the thigh. His directions are as follow:—"With a straight knife commence your flap incision at about three inches more anteriorly (lower down?) than where the bone is to be sawn through, supposing an adult, and so in proportion to the age of the patient and the size of the limb. Let the incision be continued in an oblique direction till you reach the bone, then, with the same, or a common amputation-knife, make your circular sweep, commencing from the side of your flap, directly to the bone." Mr. O'Halloran, however, had peculiar views as to dressing his stumps. He inserted a piece of lint between the bone and the flap, dressing the surfaces separately for ten or twelve days before approximating them. In 1848 this method of amputation was revived in France by M. Sedillot, and also by M. Baudens; the former surgeon, even in his mode of dressing, closely following O'Halloran, by directing a piece of lint or other digestive to be interposed between the bone and the flap for some days. On consideration it will be seen that the anterior flap, recommended by Mr. O'Halloran, is far too short. For, taking the thigh as nearly a circle, and 12 inches as an average circumference, the flap would be less by 1 inch than the diameter of the limb, or the surface which it has to cover. This, along with the peculiar mode of dressing the stump, was probably the cause of the operation falling into disuse.

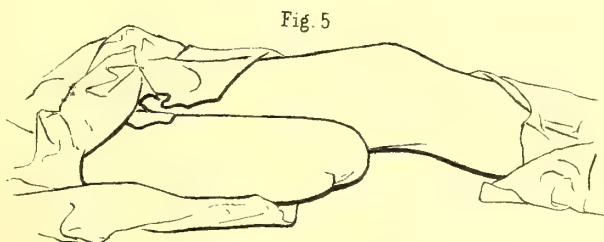
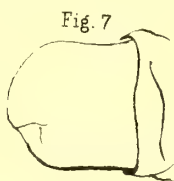
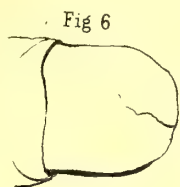
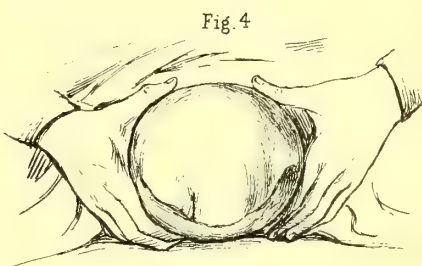
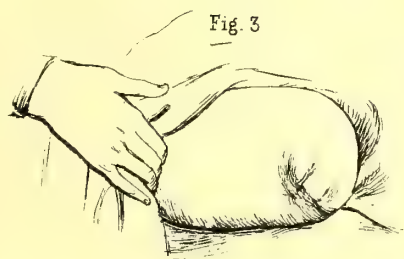
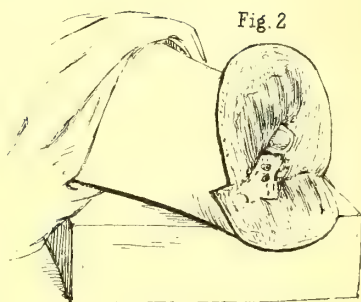
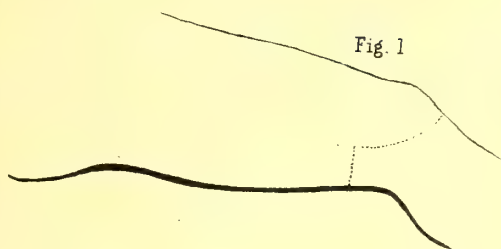
Mr. Teale's method of amputation possesses the great advantage of having the end of the bone completely covered by the sound tissue of the anterior flap, whilst the cicatrix is placed high up on the posterior aspect of the stump. It, however, has certain disadvantages. The excessive length and square

form of the anterior flap are, in themselves, serious drawbacks to the operation. Moreover, as the angles of the anterior flap require to be brought into exact apposition with those of the posterior, the anterior flap must be doubled on itself. When retained in this position by stitches, its vitality is placed in some risk, and, if union by first intention do not occur, the reflected portion of the flap is apt to fall away from the unreflected portion, thereby causing trouble in the after-dressing of the stump.

In 1858 I began to practise a mode of amputation which has yielded excellent results, and which in certain situations, as for example in the lower third of the thigh, I now employ in preference to any other operation that I have hitherto tried. The method which I adopt is that of a long anterior flap, but this is formed on a principle essentially different from that which regulates the construction of the flap in the operations of O'Halloran, Sedillot, and Baudens, and is a material modification and simplification of Mr. Teale's method. In carrying out the directions of Mr. Teale, it is absolutely necessary, as was previously observed, that the angles of the anterior flap be brought into exact apposition with those of the posterior. The anterior flap must, therefore, be doubled on itself, and in order to admit of this its length must be equal to one-half of the circumference of the limb, so that in a thigh twelve inches in circumference, if we do not obtain an anterior flap at least six inches long, the operation cannot be accomplished. In the method of amputation which I employ, the anterior flap is not formed with the design of being doubled on itself, but is simply made of such a size and shape as will allow it to fold loosely over and cover the posterior segment of the stump. For this it is necessary that the flap, throughout its extent, be in breadth fully equal to one-half the circumference of the limb, and that it be gently rounded at the extremity, so as to adjust readily to the curve of the cut margin of the posterior half of the stump, whilst it must be sufficiently long not merely to cover, but to hang loosely over, the posterior cut surface, so that the cicatrix may be placed ulti-

mately on the posterior aspect of the thigh, and without the flap being tensely stretched over the end of the bone. In my own operations I judge of the proportion by the eye, but a flap of four inches would be found sufficient in a limb twelve inches in circumference. The soft parts on the posterior aspect of the limb are divided obliquely towards the bone, the incision beginning two inches lower than the level of the base of the anterior flap. Due attention must be paid to the mode of preparing the bone for section. The thigh should be somewhat elevated towards the pelvis, the soft parts retracted, and the bone cleared two inches higher up than the base of the flap. By elevating the thigh, the bone is projected to the utmost, and if sawn close to the soft parts, it will be found, on the limb being lowered, to be deeply buried, and the anterior flap hangs loosely over it.

In regard to the textures composing the flap.—I generally operate as low down as possible, the lower margin of the anterior flap being on a level with or below the patella, so that the lower part of the flap is chiefly composed of skin; but then I cut obliquely upwards through the anterior muscles to the bone, so as to have a thicker cushion of texture directly corresponding to the sawn end of the bone. Lastly, the great vessels must be left in the posterior part of the stump, and not included in the flap. Keeping these points in view, the operation may be briefly described thus:—Supposing that the right thigh is to be amputated, the surgeon, standing on the inner side of the limb (so as to be able to grasp the distal portion of bone when sawing), inserts his knife deeply, pretty far back on the outside of the thigh, and about three inches above the patella. He then carries the knife downwards through the skin and fascia to a level with the lower edge of the patella, and after cutting, with a gentle curve, across the front of the limb, he carries the incision up the inside of the thigh, to a point opposite the place where he commenced it. Whilst he is making the incision, his assistant retracts the skin and fascia, and when, by a few touches with the knife, the muscular tissue of the thigh is exposed, the surgeon cuts obliquely through it to the bone so as to dissect up



the flap from the femur ; then applying the edge of his knife to the soft parts on the posterior aspect of the limb at least two inches lower than the level of the base of his flap, he cuts them with a sweep obliquely to the bone. The assistant next retracts the soft parts, whilst the surgeon clears the bone for nearly two inches with a circular movement of the point of his knife. The femur then being elevated so as to project it fully, is sawn through close to the soft parts, immediately above its condyloid portion. The femoral artery is very easily seen towards the inner side of the posterior section of the stump, and when it and other bleeding vessels are secured, the flap is allowed to fold over the face of the stump, and is then adjusted and retained by sutures.*

This plan of amputation possesses all the advantages of Mr. Teale's method, without requiring the troublesome adjustment of the angles of the square flaps, or the doubling back of the anterior flap upon itself. Nor does the anterior flap require to be of the excessive length which is necessary in that surgeon's operation. The after-dressing is also simplified, for if union by first intention does not occur, the flap, by its own weight, naturally tends to keep in position. Another important distinction consists in the bone being sawn through higher up than the base of the flap. It may appear, at first sight, that cutting a flap four inches long, and then making the section of the bone two inches beyond its base, is simply equivalent to making a flap six inches in length. But it is not so. A flap, however long, does not afford that deep, permanent covering, which results when the bone is buried amongst the textures, beyond the base of the flap, after being cleared by Alanson's method, whilst the cut surface exposed is also less.

In 1863, Mr. Carden of Worcester published an account of his method of amputation by single anterior flap, composed entirely of skin. The form and position of the flap are very similar to those of my method, but the base of the flap is not quite so high up, as Mr. Carden saws through the condyles of the femur, and, as I have said, the flap is composed entirely of

* See Plate xxxiv.

skin. I have performed several operations by this method, and seen many stumps formed by it, but these have all been decidedly inferior to those formed either by Teale's operation or my own, being wanting in thickness of soft parts over the end of the bone. In some cases I know the bone has caused ulceration of the part of the flap corresponding to it, and consequent adhesion to the bone. In some cases, also, I believe, great trouble has been caused by continued oozing, and even smart hæmorrhage, from the cut surface of the condyles ; whilst, from what I have seen, I do not think the results show this method to be less dangerous to life than the other, in which the bone is sawn through immediately above the condyles, and a moderate amount of muscle preserved to form a protective cushion for it.

In a paper on amputation by Professor Lister, in Holmes' *System of Surgery*, I observe that in speaking of my plan of amputation, whilst he admits some of its advantages, he seems to think that it still involves the necessity of amputating higher in the thigh in order to procure a sufficiently long anterior flap. Now, what I consider to be one of the great advantages of the operation is, that it enables us to amputate lower in the thigh than we can do if we employ the double-flap method ; for, as that part of the flap which is to be behind the bone does not require to contain muscular tissue, we are enabled to cut the flap as low down as below the margin of the patella.

Although convinced of the advantages of the single-flap operation at the lower third of the thigh, I would not sacrifice any extent of the limb merely to obtain a long anterior flap ; and, as Professor Lister had seen several of my cases, he might have noticed that the stumps were all much longer than when made by the ordinary flap method. The method which Mr. Lister proposes of an anterior flap somewhat longer than usual, and a shorter posterior flap, is in fact my modification of Liston's double-flap operation, which I had long taught and practised, and which, in a previous part of these lectures I have fully described. This modification I still prefer in certain cases, but, after considerable experience of both plans, I have abandoned it,

as a general rule, in favour of the method by a single anterior flap.

In other amputations, as in those of the arm and forearm, whilst the single flap may be adopted, it has fewer advantages. From the form of the limb, and its position when the patient is lying in bed, the flap does not adapt itself, by its own form and weight, to the cut surface, but, being placed more or less laterally requires to be retained in position. In these situations a modification of it answers sufficiently well. In the upper arm a stump formed by a single flap from the outer and anterior aspect of the limb, the inner aspect being divided circularly a little below the level with the base of the flap, possesses the advantage of having the great nerves divided high up and so removed from the end of the bone, which is covered by a good cushion of soft parts. The cicatrix is also placed high up on the inner side, beyond all risk of pressure. In amputation at the shoulder-joint, the method I prefer is also that by a single flap, cut in a particular direction. As a general rule and for the reasons already advanced, I consider the single flap preferable, as forming a better covering of sound textures, and removing the cicatrix from pressure ; but in certain amputations, and in particular circumstances, a modification of it, or two equal flaps, may answer better. Thus, in cases of amputation for malignant growths, I would advise the modified circular method, or two equal short flaps principally composed of skin, because in such cases we desire to avoid having any part of the flap cut from near the tumour, and the muscular tissue should be largely removed, being liable to contain proliferous cells, even at some distance from the growth, and a long flap of skin, from which the subjacent muscles have been dissected, has its vascular supply impaired, and is very apt to slough. Again, in certain situations, as in some amputations of the foot, the position of the cicatrix in reference to the direction of the pressure of the boot, requires to be considered ; and finally, I need hardly remark that in cases of injury we cannot select our method of operating, but must modify it according to circumstances.

LECTURE LXXXV.

Amputation continued—Prevention of Hæmorrhage during the Operation, and its arrestment afterwards—Immediate and After-treatment of Stumps.

As regards the arrestment of hæmorrhage in amputation, we have, first, to attend to the temporary bleeding during an operation; and, secondly, its permanent arrestment after the operation.

In the great amputations in private, and also in hospital practice, the ordinary tourniquet is the safest instrument for arresting bleeding during the operation. At one time this method was objected to as entailing a larger loss of venous blood than necessary; but this is more a theoretical than a practical objection, for if the ordinary surgical tourniquet be put on properly, and not screwed up till that is done completely, no great loss of venous blood will take place. If it be screwed up partially, the veins will become congested, and so venous hæmorrhage will take place; but in that case the fault is in the method of using it, and not in the instrument itself. There are various tourniquets in use; some are made so as to compress only two points of the limb—namely, over the main artery and a point directly opposite—these instruments control the flow of blood through the main channel, but allow the intermediate collateral circulation to be carried on, and are therefore not so good as the common one. In an œdematous limb the tourniquet is very apt to get slack as the serous fluid escapes, and we should therefore be careful, if the serum escapes rapidly, to tighten it so as to prevent any loss of blood. It is better to compress the main artery by means of the fingers, if we have a good assistant, for this does not interfere with the retraction of the muscles. When the tourniquet is used, the muscles are prevented from retracting to their full extent at the time, and on

removing the tourniquet they retract very quickly, and we find that the bone projects more than we expected, so that an assistant's fingers are the best compressors we can have. In the case of the femoral artery, the compression should always be on the brim of the pelvis, and never on the femoral artery in the thigh, for by the former method we get complete command over the vessel. The brachial artery should always be compressed very high up, just where the axillary artery ends, no matter at what part of the arm we are going to amputate, because the brachial artery in the middle of the arm is very movable; and if it slips from under the assistant's fingers, it is often difficult to get it compressed again.

The permanent arrestment of hæmorrhage, is effected in the usual way, by ligature or by acupressure. In using the ligature the vessels are drawn out and tied close to the soft parts; the loop of the ligature should always be passed over the point of the artery forceps before being at all tightened, and the vessel should be tied as far from the forceps, and as near the soft parts of the stump as possible. If any small branches are seen coming off from a large artery, the vessel should be dissected up a little, and tied above the point where the branches come off.

The after-treatment of the stump may be said to be the same as that of an incised wound, though practically it is not a simple incised wound, but a very large cut surface, including all the various soft textures of the limb, and having at its deepest part either a section of the bone or an articular surface. When we reflect on the various degrees of vitality, and therefore of reparative power, in the different textures forming the stump, we can scarcely expect all these textures to heal exactly in the same time or in the same way. Those endowed with much vitality, such as the skin, cellular tissue, and muscles, are generally united very soon, while the tendons and the osseous textures are undergoing slower processes of healing and alteration in form. In the case of the denser and less highly vitalised tissues, the amount and extent of action which follows the operation, whilst it may not be excessive for the softer tissues, may

yet prove too much for the vitality of the denser textures ; and portions of fascial or tendinous tissue, instead of healing, may slough. The bone too requires to be rounded off, and during that process, in a very dense bone or after primary amputation, we may have slight molecular necrosis taking place, and abscesses forming from time to time as these minute portions separate. Great exfoliations of the bone are not very common now-a-days, and even acute necrosis, after primary amputation, is not very frequent, but slight molecular necrosis is not uncommon from the bone rounding off ; its denser texture, instead of opening out and yielding, dies under the excited action ; there is, in fact, a slower process of alteration and healing in the denser than in the softer textures.

Again, as regards the state of the parts in which we amputate. When we amputate for a diseased knee-joint, for example, we very often have to cut through abscesses and other textures, which are so far unhealthy, and which cannot, therefore, be expected to heal by the first intention. Absolute and complete primary union cannot, therefore, be often expected, but, under ordinary circumstances, we find that a very large proportion, if not the whole, of the stump does heal by adhesive action, portions here and there not being so united, and this is generally due to the character of the textures entering into its formation.

The simple plan of dressing incised wounds was first applied by Mr. Liston to the treatment of stumps. His rule used to be to tie the vessels and wash the flaps, laying the latter in contact ; the patient was then removed to bed, and cold water was applied upon the stump for six or eight hours, till the oozing ceased and a layer of lymph was thrown out on the surface, then the edges of the wound were brought together by sutures. The object of this was to get rid of all oozing and clots of blood, and to let the surface of the wound glaze by effusion of lymph ; the plastic surfaces were then brought together, and the water-dressings were continued, along with slight compression by a bandage. This plan looked very well in theory, but in practice it did not

answer. It was found that the stumps did not heal readily ; the flaps, lying loose, were disturbed by every movement of the limb, and this caused more oozing than would otherwise have happened. This plan was, therefore, soon given up, as it was found to be very inconvenient. The application of cold was beneficial, no doubt, but this should never be carried beyond a certain point, as it may induce a low form of inflammation in the stump, unless it be applied in the form of dry cold by means of ice, which seemed to answer well in the practice of Langenbeck and others, in the late war in Schleswig-Holstein.

In the double-flap amputation, a broad pad of lint is placed in front, and another behind ; a piece of lint is also applied loosely on the surface of the cicatrix, and a bandage is applied so as to prevent any movement. A small part of the wound is always left open at the most dependent point, to allow the blood and serous discharges to escape. At one time there used to be a great dispute regarding the form in which the edges of the stump ought to be brought together. It was disputed whether in the circular amputation the wound should be brought together perpendicularly or transversely ; the advocates of the former view showed that by this plan, when the stump rested on a pillow, the lower part naturally tended to be pressed upon, and so the fluids from the stump could escape readily, while, if the opening were transverse, there was no ready escape for the matter. The fact is, that both in the circular and double-flap amputations, when the cicatrix is transverse, the wound lies obliquely, owing to the form of the limb, so that in reality there is a dependent opening at one side, just as much as if the line of incision were perpendicular. The method of after-treatment I employ is to wash the surface of the wound immediately with cold water, and clear out all the clots of blood. In amputation through diseased textures, as scrofulous joints, or if the remains of the pyogenic membranes of abscesses were present, then I used to apply carbolic acid in methylated spirit to the stump ; but I have given this up, as I have found more benefit from the use of tincture of iodine. This destroys the pyogenic membrane, and prevents

suppuration from taking place to a great extent, so much so, that I used also to apply it to healthy flaps, with a view to prevent great suppuration. The solution of chloride of zinc I have also used with advantage, and still use it after amputations for malignant tumours, but it is often too irritating, unless used weak; still I now prefer it or the iodine to any other local application, though, in most cases, it is best to avoid all such remedies. Having cleansed the wound and arranged the ligatures, I next bring the flaps into contact with sutures, about an inch apart. The parts should be held in accurate apposition as we put in the stitches, and we should begin either in the centre or at one of the angles of the stump.

Cold-water dressing is to be applied to the surface of the stump for about six or eight hours, but after that time I would leave off all moist dressings. If, when the wound is healing, we apply water-dressings to it, with gutta percha tissue over the lint, we are just applying what will act as a poultice, and break up the newly-formed cicatrix. The stump should be placed on a soft pillow, with a sheet of gutta-percha under it, and a piece of dry lint laid over the surface like a veil, and then a wire cradle placed over it to keep off the weight of the bed-clothes. In many cases, indeed, we may dispense with the dry lint, and leave the stump without any dressing, and merely covered by the bed-clothes. In the double-flap and circular amputations we require to place pads of lint on the stump, so as to keep the surfaces together; but in the single-flap operation the flap remains naturally in position.

No attempts should be made to force the union of the stump. If we attempt to force the union by compression, instead of advancing we are very likely to hinder it, and to cause strangulation and gangrene at certain parts of the stump. Long ago different forms of apparatus—plates of metal or wood—were used for keeping the surfaces of the flaps in very accurate contact, and preventing blood collecting between the flaps; but this only serves to irritate the parts, and is therefore to be avoided.

THE CONSTITUTIONAL AFTER-TREATMENT must be conducted on the general principles already laid down in regard to the after-treatment of all great operations, modified, of course, in individual cases by the peculiarities of the case, or the idiosyncrasy of the patient.

LECTURE LXXXVI.

Amputation continued—Causes of Mortality—Statistics—Circumstances modifying the Value of the Information derived from them—Table exhibiting the Results of Author's Practice—Comments on and Deductions made from them.

THE consideration of the causes of the mortality after amputation is a subject so wide, that I cannot be expected to enter on it in all its phases fully in a course of lectures such as this, where so many subjects demand our attention. I will, therefore, confine myself to treating of it from certain points of view, which, from my own experience, I believe to have practical bearings.

Of late years much has been written on this subject, and large statistics have been published, from which certain general deductions may be drawn;—the most usual deduction being that amputations of the limbs are very dangerous operations, and those of the lower extremity specially fatal.

Now, for my own part, I cannot see any great benefit to be derived from this kind of information, unless it be intended to indicate the propriety of abandoning the operation. However desirable it may be to possess the data established by such statistics, I think it might have been predicted, that in such an operation as amputation, an operation of last resort, and performed often under most unfavourable circumstances, the mortality would be great; and yet I should think such considerations would not deter any man of sense and experience from performing an operation which gives the only reasonable chance for life. But what I do consider to be of practical importance is to ascertain how far the operation in itself is necessarily of great danger, or whether the dangers are greatly due to circumstances under which it is performed. It is quite possible that the statistics of an operation not dangerous in itself may show results very startling in regard to the amount of mortality attending its performance, due to the circumstances

under which it is performed. The operation for strangulated hernia is an example of this. That operation is, I believe, attended with no danger in itself: the causes of death are invariably to be found in the state of the abdominal viscera antecedent to the operation; and the tables of mortality are swelled by undue delay in operating. The same thing, indeed, cannot be said of amputation, for it has inherent dangers; but I believe many circumstances which determine the favourable or unfavourable result are to be found in the different circumstances under which it is performed.

The statistics of amputation have been rendered of practical service in reference to the question of primary and secondary amputations, because they have been made comparative; and the results have established this great practical fact, that however great the mortality may be in primary amputation, delay in similar cases of injury, with a view to secondary amputation, is still more fatal. Hence the surgeon feels that, when the case is one presenting no reasonable chance of recovery without amputation, he gives his patient the best chance by performing the operation at once. Little, however, has been hitherto done in comparing the immediate results of amputations performed for different diseases. Indeed the usual tabulated form in statistics of amputation is, *Primary, Secondary, and for Disease*; and thus, I believe, much valuable information is lost. Moreover, I think that more useful information would be obtained from statistics of the results of the practice of individual operators, with remarks as to any peculiar circumstances in the cases,*and stating the nature and site of the injury or disease for which the amputation was performed, than from the larger general statistics at present referred to. It may be objected that the experience of any one man is too small for purposes of generalisation, but the aggregate of such statistical returns would give the general result—the operative procedure by the same surgeon would give equality in that respect; whilst we would obtain details which, I believe, would have most important effects on practice. In my own practice, both in hospital and private, I have kept such a record

of the greater amputations which I have performed, and I shall now use it in trying to ascertain, or at least suggest, what are some of the causes influencing the results of amputation. My experience in performing amputation, though necessarily small in comparison with general statistics, is yet, I think, sufficiently large to entitle me to form some opinions on this subject; and I give them to you, along with some suggestions to assist you to elaborate the subject more fully with your own experience in practice hereafter.

The following tables exclude all amputations of less magnitude than those at the wrist and ankle joints. The first or general table gives the results of 403 amputations for all causes, and the information it affords is of the usual kind—namely, that out of a given number of cases of amputation so many recover and so many die. The subsequent tables show the results of the different amputations I have performed, under the heads of primary, secondary, and for disease, the last head being subdivided so as to indicate the results of the operation in different diseases, and according to the situation of the disease. A glance at the results of amputations performed for different forms of disease will suggest the object I have in view, to try to ascertain the probable causes of the greater mortality in certain cases, and how far these dangers are avoidable, or may be lessened.

TABLES showing RESULTS of AMPUTATION.

TABLE I.—GENERAL RESULTS.

LOWER EXTREMITY.	Total.	Recovered.	Died.
Hip-Joint . . .	9	3	6
Thigh . . .	155	100	55
Knee-Joint . . .	1	0	1
Leg . . .	53	37	16
Ankle . . .	82	76	6
	300	216	84

UPPER EXTREMITY.	No.	Recovered.	Died.
Shoulder-Joint . . .	23	17	6
Arm	33	21	12
Forearm	43	35	8
Wrist-Joint	4	4	0
	103	77	26
Total Upper Extremity .	103		
„ Lower „	300		
	403	293	110

TABLE II.—RESULTS in relation to Injuries or Diseases for which the Operation was performed.

STATISTICS OF AMPUTATION—LOWER EXTREMITY AT HIP-JOINT.

	No.	Recovered.	Died.
INJURY. { Primary	5	1	4
{ Secondary	0	0	0
DISEASE { Malignant Tumour of Femur	2	2	0
{ Malignant Tumour of soft parts	1	0	1
{ Chronic Disease of Neck of Femur	1	0	1
Total of Hip-Joint . . .	9	3	6

AMPUTATION OF THIGH—INJURY.

PRIMARY	20	6	14*
SECONDARY. { Burns	3	2	1
{ Acute Necrosis after fracture	2	0	2
{ Gangrene (Traumatic)	4	1	3
	29	9	20

DISEASE.

Disease of Knee-Joint . . .	79	67	12
Necrosis and Secondary Disease of Knee-Joint	13	8	5
Acute Necrosis of Femur (Idiopathic)	8	1	7
Necrosis of Shaft of Femur . .	6	4	2
Carry over	106	80	26

* The causes of death in the 14 fatal cases were—In 7 Shock and Hæmorrhage; in 2 Gangrene; in 5 Pyæmia.

	No.	Recovered.	Died.
Brought over	106	80	26
Repeated Hæmorrhage after removal of			
Necrosed Fibula	1	1	0
Malignant Tumours of Femur	11	5	6
Malignant Tumours of Tibia	3	3	0
Erectile Tumour of Leg	1	0	1
Gangrene in Diffuse True Aneurism	1	0	1
Large Strumous Ulcers of Leg	3	2	1
	<u>126</u>	<u>91</u>	<u>35</u>
Total of Thigh	155	100	55

AMPUTATION AT KNEE-JOINT.

PRIMARY	1	0	1
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LEG.

	No.	Recovered.	Died.	
INJURY	Primary	28	15	13
	Secondary	3	1	2
DISEASE	22	21	1	

} Railway and cart
accidents.

ANKLE-JOINT.

INJURY	Primary	4	3	1
	Secondary—Gangrene	1	1	0
	Contraction	1	1	0
	from Burn			
DISEASE		<u>76</u>	<u>71</u>	<u>5</u>
Total		<u>82</u>	<u>76</u>	<u>6</u>

UPPER EXTREMITY—AMPUTATION AT SHOULDER-JOINT.

FOR INJURY.

PRIMARY	Gunshot wound	1	1	0
	Railway Injuries	8	4	4
	Machine Injuries	6	5	1*
	Waggon-wheel passing over			
SECONDARY	Arm	1	1	0
	—Effects of Burn	2	2	0
	Total	<u>18</u>	<u>13</u>	<u>5</u>
DISEASE	Subclavian Aneurism	1	1	0
	Malignant Tumours	4	3	1
Total Injury and Disease		<u>23</u>	<u>17</u>	<u>6</u>

* Secondary Hæmorrhage.

ARM—FOR INJURY.

		No.	Recovered.	Died.
PRIMARY ...	{ Gunshot . . .	2	1	1
	{ Railway . . .	6	2	4
	{ Machine Injuries .	4	3	1
	{ Compound Dislocation of			
	{ Elbow and Fracture	1	0	1*
	Total . . .	13	6	7
SECONDARY .	{ Traumatic Gangrene .	3	2	1
	{ Necrosis after Injury of			
	{ Forearm . . .	1	1	0
	{ Effects of Burn . .	3	2	1
	{ Gunshot wound of Hand	1	1	0
	{ Machine Injury of Hand			
	{ and Forearm . . .	1	0	1
		9	6	3
Total for Injury—Primary and Secondary		22	12	10

ARM—FOR DISEASE.

Osteo-Sarcoma of Forearm . . .	1	1	0
Strumous Disease of Elbow and Forearm	8	7	1
Results of Erysipelas . . .	1	1	0
Acute Necrosis of Humerus in a			
Child	1	0	1
Total for Disease . . .	11	9	2
Total Injury and Disease . .	33	21	12

FOREARM—FOR INJURY.

PRIMARY ...	{ Machine Injury . .	21	18	3
	{ Gunshot do. . .	6	5	1
SECONDARY .	{ Traumatic Gangrene	1	1	0
	{ For Sloughing of Flaps			
	{ after Wrist Amputation	1	1	0
Total Injury . . .		29	25	4

* A woman of intemperate habits, ætat. 70.

FOR DISEASE.			
	No.	Recovered.	Died.
Erectile Tumour	1	1	0*
Disease of Carpus	12	9	3
Epithelial Cancer	1	0	1
	14	10	4
Total Injury and Disease . .	43	35	8

WRIST.			
Primary	3	3	0
Disease	1	1	0
	4	4	0

As to primary and secondary amputation, as I have said, so much has been done by comparative statistics, that I shall merely advert briefly to some circumstances which, in my opinion, cause the great mortality attending primary amputation.

The general conditions which most evidently determine the unfavourable issue are—shock, loss of blood, gangrene of the stump, or pyæmia; and, from my own experience, I would add the co-existence of other lesions, not in themselves very dangerous, and great comminution, especially longitudinally-fissured fracture of the bone or bones through which the amputation is performed; and, lastly, certain moral causes reacting on and depressing the physical powers.

Shock, or that peculiar effect of injury on the vital powers, mental and physical, with tendency to collapse, though difficult to define, is only too obvious in most cases of injury requiring amputation, to be overlooked as a condition unfavourable to the result, whether by depressing the vital powers so that reaction does not take place, or from the effects of over-reaction in a patient whose vital powers are for the time diminished. It may be accompanied and aggravated by hæmorrhage; but even without any loss of blood, the effects induced by the shock on the nervous system are always marked by extreme depression and

* In an infant six weeks old, amputated in consequence of hæmorrhage from the tumour.

collapse, and that even when the patient's feeling of pain seems to be benumbed rather than exalted. Very little irritation or pain, or exposure to cold, superadded to this state, I believe to be sources of great additional danger, both immediate and secondary; and to these causes I attribute much of the fatality which attends primary amputation in civil hospital practice, where most of the cases are brought from some distance—often from a long distance—by cart or railway. The state of a patient with a torn and broken limb, carried even with the greatest care, is aggravated by the slightest movement, and fresh shock superadded. I have on two occasions accompanied patients under these circumstances from short distances in the country, and though an opiate had been given, and the fractures were arranged and supported, the limbs slung, the carriages very easy and the roads good, yet the slightest jolt or sudden motion of the horses caused exacerbations of suffering and faintness, requiring the administration of stimulants. In one of the two cases alluded to the soft parts were principally injured, the fibula alone being fractured. If such were the effects of removal under every advantage, I could not help asking myself what must be the condition of most patients brought to hospital with severe injuries? The loss of blood resulting from the injury, and any subsequent hæmorrhage, either during the transport of the patient or in the amputation, is so evident a cause of danger, so frequently associated with and aggravating the shock, that I need not dwell on it further than to point out the necessity of prompt attention to this so soon as the patient comes under your care. You should not only be satisfied that there is no hæmorrhage externally, for I have frequently found bleeding taking place into and infiltrating the limb; and the patient may sink from this cause. Indeed, I have not unfrequently been obliged to amputate when the pulse was very weak, because, from this kind of hæmorrhage, it was obvious that delay would only have led to greater debility from loss of blood. Under other circumstances, it is always proper to have a fair amount of reaction before

operating. Having said this much of the effects of shock and loss of blood, let us look now how some primary amputation cases are situated as to these dangers.

Of the five cases of primary amputation at the hip-joint, one was brought a distance of more than fifty miles, partly by cart, over bad roads in a hill district, and partly by railway, and was admitted into hospital late in the evening, the injury having been received about half-past six in the morning. The injury occurred from the explosion of a large iron flask containing gunpowder, which he had in the pocket of his trousers. The whole of the thigh, abdomen, and lower part of his thorax were scorched ; all the soft parts on the front and inner part of the thigh, with the exception of the femoral artery, torn through ; and the branches of the profunda were bleeding into the textures of the limb, so that amputation had to be performed at once. In another of the fatal cases the patient had one limb shattered and torn off immediately below the knee, and a severe compound fracture of the other leg. In this case there had been great loss of blood at first from the torn arteries of the severed limb, but it had been arrested by tying a handkerchief round the limb and twisting it tight by means of a stick used as a rack-pin. In the third case, the patient was brought from a distance, and had evidently suffered both from severe shock and loss of blood prior to the operation. Neither of the last two cases ever fairly recovered from the effects of shock. In both of them the injury was caused by a train of railway trucks passing over the limbs, and the patients were otherwise bruised, though there were no internal injuries. In another case, a little girl, six years of age, was run over by a heavily-laden cart. The wheel passed over her right knee and left thigh, producing a lacerated wound of the former and a compound comminuted fracture of the latter, with extensive destruction of the soft texture in front to within three inches of Poupart's ligament. The accident happened in town, and the child was admitted into hospital half-an-hour after the accident. There had been profuse bleeding at first, but that had been

arrested before admission. I amputated some hours afterwards, when reaction was established. There was little sound texture to form flaps, and some sloughing of the margins of the flaps took place. For a time, however, the wound looked so healthy that I was in hopes of her recovery. But ultimately she became very much exhausted, and died about eighteen days after the operation. In this case there were some peculiar conditions which probably affected the result unfavourably. Besides the injury of the limb amputated, there was a laceration of the textures over the right knee, a second source of irritation. But there was also an unfavourable state of constitution, for the injured knee had been the seat of disease, and she had previously suffered from necrosis. Both these conditions had been successfully treated in my wards about a year previously ; but, of course, the state of the parts when subjected to a new irritation must have reacted unfavourably on the health, tending to produce exhaustion after the amputation.

The fifth, which is the first and only successful case of primary amputation at the hip-joint, so far as I know, which has yet occurred in Scotland, was performed under different circumstances. I was sent for and performed the operation in the country, so that the lad had only been removed from the railway station, where the accident happened, to his own home, a very short distance. He was carefully carried on a litter, the injured limb having been first supported by a splint. In all other respects, the conditions were certainly not more favourable than in hospital. The injury was a severe one, attended by some loss of blood, though that was arrested by the medical man who first saw him. Eight or nine hours had elapsed from the time of the injury till I reached him, and he was then much depressed. The operation was performed under certainly less advantageous circumstances than in hospital. For although the professional assistance I had was excellent, still I had to depend upon non-professional aid for the performance of some important duties ; and when I add that the operation was performed in a small room, with no other light but that afforded by

two small tallow candles and a wax taper which I had brought with me, the circumstances will not compare favourably with the advantages of an hospital operation. Yet the compression of the vessels was so efficient, that the amount of blood lost, when collected and measured, did not quite half fill a small teacup. In regard to the after-treatment, the patient was no doubt in the country, and it may be said that pure air is everything, and certainly it is most important ; but the house was small, the room in which he lay, so small that one person only could stand between his bed and the wall, and the only window in it was composed of a single small pane of glass. The street of the village was narrow, and with surface drainage. Yet this patient made a good recovery. Was it due to the pure country air, or to his not having been removed to a long distance after the injury, and so having been saved from increased shock ? I cannot help thinking that it was chiefly due to the latter circumstance. I have come to that conclusion from what I have observed in cases of other primary amputations, such as those through the thigh and leg ; for, whilst the amputation of the hip is undoubtedly a very serious operation, similar circumstances to those I have mentioned seem to determine the favourable or unfavourable result in other amputations. In the fatal cases of primary amputation of the thigh and leg, almost all had been brought from a distance, or after long exposure and having lost blood, and in the majority other injuries were present. In the successful cases, on the other hand, the operation was either performed in the country, where the accident took place, or else the nature of the injuries was peculiar, consisting either of laceration and destruction of the soft textures, of ploughing up of the texture of the bone by toothed machinery, or compound impacted fracture, or else means had been taken to arrest all bleeding and adjust the limb previous to their removal to the hospital. The patients in the successful cases had thus either been saved all shock, except that of the original injury, or any secondary shock in those who were removed to hospital had been considerably diminished either by the character of the lesion or the means taken to prevent motion of the

injured parts and loss of blood. I think that the circumstances alluded to are obviously in accordance with what we might expect when we consider the effects of such injuries as those entailing a necessity for amputation. By the first shock of the injury the patient is as it were stunned, the sensorial functions are disturbed, and his general feelings benumbed, so that pain is seldom complained of; but as he revives and becomes excited, his nervous sensibility becomes exalted, disturbance in this condition causes excessive pain, gives rise to shivering and a feeling of sinking, and produces a marked effect on the pulse. This I have observed in the cases in which I accompanied the patients to town, and I therefore have come to regard removal of cases requiring amputation as of very doubtful propriety. But whilst I draw your special attention to this, there are various other conditions which are obviously causes of danger in cases which are brought even from a short distance. The patients may be exhausted by exposure, loss of blood, and prolonged suffering, as happened in some instances where the accident occurred during the night, and the sufferers remained undiscovered for many hours during an inclement wintry night.

Gangrene of the stump is not, according to my experience, frequent in cases of primary amputation. I have met with only three cases in my own practice. Two of these occurred after amputation at the upper third of the thigh, for severe railway injury, and in both there had been great loss of blood previous to the patient having been brought into the hospital. In one the gangrene attacked the surface of the stump on the second day after the operation, and proved rapidly fatal. In the other patient the gangrene was partial, arising apparently in some deep muscles which had suffered injury above the point of amputation. A considerable part of the wound had healed on one side of the stump when foetid discharge began to take place. Arterial hæmorrhage occurred, and on opening up the stump to arrest the bleeding, the sloughy state of the deep part of the wound was noticed: the sloughing had opened into the femoral artery about an inch and a half above the point where it had been tied in

the amputation. The vessel was secured higher up, but the deep-seated sloughing continued and the patient gradually sank. In the former of these cases, the patient had suffered both from excessive shock and great loss of blood; and when brought into hospital he was so collapsed that it was doubtful whether he could bear the operation, but as bleeding was going on into the tissues, the operation seemed his only chance. The main artery was compressed and stimulants given, but during his removal from the receiving-room to the operating theatre his respiration and pulse became so feeble, that I had again to give stimulants and wait for some reaction before operating. We can be at no loss to understand how, in a patient so debilitated, the general and local vital powers should be so impaired as to lead to gangrene, instead of healthy reparative action. The second case was more insidious in its course, as beyond the foetid discharge from one part of the stump, there were neither local nor general symptoms indicative of gangrene. The secondary hæmorrhage caused by the sloughing, by debilitating the patient, doubtless made the after-progress of the gangrene more rapid. The third case of gangrene of the stump occurred after an amputation of the forearm, performed on account of gunshot wound of the hand. The patient, a man of excessively intemperate habits, was attacked with delirium tremens the day after the operation. Erysipelas of the stump, forearm, and arm supervened, and assumed the gangrenous character and proved fatal. In this case the previous habits and broken-down constitution of the patient, rather than the amputation or the nature of the injury, must be looked to as explaining the tendency to gangrene.

The most general cause of death in cases of primary amputation, when the patients survive the more immediate dangers of shock and loss of blood, is the condition termed pyæmia.

Pyæmia is often spoken of as if it were specially an hospital disease, depending on the effects of hospital air. From the greater number and severity of the surgical cases occurring in hospital, we can scarcely wonder that pyæmia should be more

frequently met with there than in private practice; but it is by no means confined to hospitals; and from considerable experience and observation of this diseased state, I believe that its occurrence is much more determined by the state of the patient prior to an operation, or to depressing causes occurring afterwards, than is generally admitted; and that in cases of primary amputation, besides the more obvious depressing causes, certain forms of lesion specially conduce to its occurrence. Thus I have noticed that the risk of pyæmia is always greatest in cases where the amputation has been performed through the continuity of the bone or bones which had been fractured. This is specially noticeable in primary amputation of the leg and upper arm, for railway and gunshot injuries. In these cases the fatality attending the operation is very great, whilst in cases where, from the severity and extent of the injury, we are forced to amputate beyond the injured bone at the shoulder-joint, or immediately above the knee, the success is greater. In cases of amputation at the shoulder, I am so satisfied of the diminished risk to the patient, that I feel relieved when the nature of the injury leaves no room for amputation through the injured humerus. In the fatal cases of primary amputation at the shoulder, the deaths were due to the effects of other injuries, and the great loss of blood in one case prior to the operation; but in my own practice I never saw a patient die from pyæmia after primary amputation at the shoulder.

As a general rule, the less of the limb removed, the less is the risk, but there are exceptions to all rules; and in cases where a bone is much shattered, the risks of acute necrosis and osteo-myelitis attacking the bone of the stump, and so inducing pyæmia, are so great as to warrant in many cases amputation at or above the neighbouring joint. The co-existence of other injuries not in themselves dangerous, such as simple fracture, or even contusions of other parts of the body, always exercise an unfavourable influence in cases of primary amputation; and, of course, when these injuries are more severe, the risk is greatly increased. In most cases of pyæmia the bone of

the stump is found necrosed, and the medulla is often seen to project like a fungoid mass. In such cases it is usually assumed that this condition is the cause of the blood-poisoning. No doubt, it may be said that it is quite as likely that the state of the bone is the effect rather than the cause, for all the soft parts show diseased action as well as the bone, and besides we occasionally see even acute necrosis of the bone of a stump without pyæmia supervening. Still the possibility of the disease of the bone being the cause, is just another reason for amputating beyond the continuity of a bone which has been severely comminuted and fissured longitudinally.

The moral causes which may influence the result unfavourably are more difficult to trace than even the physical. In all cases of severe injury, however, and especially in cases involving mutilation, the mental state, leading to depression, cannot be overlooked. The moral influences of the different circumstances in which, in such cases, the civilian and the soldier are respectively placed, have been stated as amongst the causes predisposing to the less favourable results of primary amputation in civil as compared with military practice.

“A tradesman,” says the late Sir G. Ballingall, “who has, perhaps, an indifferent constitution, and a wife and family dependent upon his exertions, is admitted with an injury requiring amputation, which may be the result of an accident originating in intoxication, ignorance, or folly, and by which he finds himself suddenly reduced to misery and dependence ; while the soldier, again, with a constitution originally sound, and accustomed to contemplate such an accident, loses his limb in a good cause, under circumstances creditable to himself and duly appreciated by his country, from which he is certain of a pension for life.”

Now, these appear very satisfactory and obvious reasons why mental depression and anxiety might be expected to be more frequent in the one case than in the other. But, whilst I consider these moral states as most important, I believe it will be found difficult to estimate correctly their influence, except in

regard to individuals. For so much depends upon the natural mental constitution, the education, habits, and age of each, that when we come to examine the question closely, it will be found almost impossible to draw any general deductions in regard to it.

The class most liable to such injuries is not in general remarkable for habits of thoughtful calculation with regard to future possibilities, consequently such opinions as that I have quoted, refer rather to what we might expect to be the state of feeling, than what we actually often find it to be. Were patients generally much influenced by the consideration of all the evils which the loss of a limb might entail upon their future prospects, we might expect to see this feeling and its unfavourable effects most generally in amputations of the upper extremity, for surely no other mutilation involves so much prospect of misery to a labouring man or mechanic. Again, when we find a man, as I have seen, suffering from the loss of a limb, his wife struck down with fever, both lying helpless in a miserable room, themselves and their children dependent on the care of strangers, we would expect this depressing influence to exert its utmost power. Yet the man in that condition seemed but little affected, and his case went on favourably to a perfect cure.

In two cases in which the bad effects of mental depression were most obvious, the circumstances were peculiar. In one, the man had in former years suffered the loss of an arm, and had felt painfully all the difficulties and privations which that loss entailed, and, when advanced in life, he lost the leg of the same side. Thus, he could not but feel to what a perfectly helpless condition such an unusual form of mutilation must reduce him, by depriving him of any means of supporting himself and his family. In the other case, the patient's feelings were painfully excited by the conduct of a young woman, to whom he was on the eve of being married, and who, immediately on hearing that he had suffered amputation, showed the depth of her affection by removing the portion of the furniture she had provided for their intended home. Previously to hearing this, he had been in good

spirits, and—except that the pulse kept somewhat high—appeared to be going on favourably ; this, intelligence, however, completely depressed him, and seemed to predispose to the unfavourable result.

In such cases as these last, mental depression and despondency can hardly be overlooked as having an important influence on the results. Still, I repeat, we can draw no exact general deductions where so much depends on the mental constitution and temperament of the individual.

There is, however, one mental state which should always be recognised, and which should influence our practice, not only in cases of amputation, but in all operations—I mean the effect produced upon a patient by witnessing or hearing of the death, or of any unfavourable condition happening to another who has undergone a similar operation. This is of course most likely to occur in hospital ; and in my own practice I make it a rule to avoid placing two patients, about to undergo the same operation, in one ward, more especially if the prognosis in either case be unfavourable ; and I feel satisfied from observation, that what are termed in some hospitals “Operation Wards,” are very objectionable both on this and other grounds, and that operation patients get on better when scattered throughout the different wards, amongst the less serious cases.

In regard to the question of secondary amputations, for traumatic gangrene and those for burns, I have already discussed these subjects, under their appropriate heads, in the earlier part of the Lectures, and therefore need not speak of them here.

I now turn to the results of the amputations performed for disease, with the view of considering what they suggest. I have already said that an operation in itself may be comparatively free from danger, and yet the condition of the patient, or the circumstances under which it is performed, may lead to its performance being attended with great mortality. Perhaps no better example of this could be found than in comparing the results of amputation of the leg for disease with those for injury. Out of 22 cases of amputation of the leg for disease 21 recovered and 1 died ; whilst out of 31 performed for injury, either primarily or

secondarily, only 16 recovered, and 15 died. But to pass from this, let us now examine into the results of amputations performed for different forms of disease.

One of the most frequent amputations is that at the lower part of the thigh for disease of the knee-joint. The absolute results of my practice in this operation give 79 cases, of which 67 recovered and 12 died, or an average of 1 death in $6\frac{1}{2}$ cases—not a very large mortality for an operation of such magnitude, and so frequently performed as a last resort. There is, however, one thing which I regret I have not sufficiently attended to in connection with this class of cases—namely, to distinguish the cases of gelatinous degeneration from those of articular caries and ulceration of the cartilage. I have a very strong impression that the result of operations, whether excisions or amputations, for gelatinous degeneration will be found much less successful than in other forms of articular disease; and of late, since I have been careful in noting the distinction, my statistics seem to justify the impression. Thus, out of 10 cases of amputation of the thigh for disease of the knee performed by me between February 1867 and 1st May 1869, 5 were cases of articular caries and ulceration of the cartilage, and 5 were cases of gelatinous or pulpy degeneration. Of the former all recovered; of the latter 2 died. I have already pointed out, in speaking of articular disease and of excision of joints, the constitutional complications to which I attribute the fatal results in the gelatinous form of disease.

When we compare the results of amputations for disease of the knee with the results of those performed in cases where the affection of the joint had either supervened upon necrosis of the femur, or in which the patient had previously suffered from necrosis, and where the sequestrum had been removed and a cure obtained, and the joint affection subsequently appeared, the difference in the mortality is very startling. Of 13 cases of the class referred to, only 8 recovered and 5 died. It seems to me that this mortality is not merely accidental in a limited number of cases, but may be traced to certain constitutional conditions. You may recollect

that amongst the fatal cases of excision of the knee-joint 2 were of this kind, and I believe that the unfavourable result in such cases is due to the unhealthy state of constitution in which idiopathic necrosis occurs, aggravated by the debilitating influences present during the prolonged process of the disease, the repeated formation of deep-seated abscesses, and the discharge prior to, and even after, the sequestra have been thrown off or removed. In such circumstances, when disease of the joint supervenes either immediately in connection with the necrosis, or manifests itself as distinct disease some time after the necrosis has been cured, it seems to me, we have to deal with a state of constitution very specially predisposed to pyæmia or other form of blood-poisoning. In the rarer cases, where amputation had to be performed for chronic necrosis of the shaft of the femur, the same conditions seem to have led to similar results. Of 6 such amputations, 4 recovered and 2 died.

As regards amputation in acute necrosis of the femur and humerus, whether the diseased action arise idiopathically or from injury, the results are so disastrous that for many years I have refrained from operating, as I believe the patient has a better chance for life by trusting to nature and careful treatment than by having the diseased limb removed. I know that it is very trying to witness the sufferings of young patients when labouring under the irritative fever accompanying acute necrosis, when it seems as if it were impossible for the constitution to bear up against the exhausting process, and when removal of the affected mass by amputation seems so ready and simple a resource. Doubtless the condition of the patient is very dangerous; but I repeat, from experience and observation of a large number of such cases, that the patient has a better chance without the operation; for we must remember what we are very apt to forget, when looking only at one view of the case, the unfavourable conditions which are likely to supervene after an operation performed in such a state, and when there is such a risk of blood-poisoning. After a time, when the irritative fever has passed into hectic, and the discharges become more dis-

tinctly purulent, and when neighbouring joints are affected, amputation may be resorted to with better prospect of success ; but in most cases the surgeon will find himself rewarded for his anxiety and forbearance by seeing his patient recover without mutilation.

The amputations performed for malignant tumours are amongst those that swell the mortality. But it may be noticed that the favourable or unfavourable results seem to be dependent on certain conditions as to the situation of the tumour, whether it is developed in the bone and confined to that structure, or has commenced in or involved the soft parts of the limb, and also by the situation at which amputation is performed. Although, in all cases of malignant disease, the state of the blood and peculiar cachexy which accompany such disease, have a marked influence in predisposing to pyæmia, thereby affecting the immediate result as to recovery from the operation ; the risks seem most marked in cases where the tumour has originally been developed in the soft parts, or in those where the soft parts have become involved secondarily. Of 11 amputations through the femur for malignant tumour, only 5 recovered. All of the successful cases were for tumours of the bone, and in 4 of them the growths were confined to the condyloid portion of the femur, whilst the amputation was performed at the junction of the middle and upper third of that bone. In the fifth case the tumour involved the lower part of the femur above the condyle, and the operation was performed through the trochanters. In 2 of the 6 fatal cases the condyles were originally affected, but in one of them the patient had refused to submit to the operation till the tumour had involved the shaft and soft parts. The other 4 were tumours of the shaft at its lower part. In these cases, except one where the tumour seemed limited to the condyle, amputation through the trochanters was performed. In 2 cases death resulted from a form of secondary hæmorrhage, or rather a continuous oozing of a sanguineous discharge from the general surface of the stump ; the others died with symptoms of pyæmia. Now, if we contrast these results

with those of cases of a similar character where the amputation was performed beyond the bone affected, I think it will appear that not only do we give the patient a better chance of subsequent immunity from return of the disease, but that we diminish the immediate risk to life by performing what at first sight may appear a more serious operation : Thus—of 4 cases of amputation at the shoulder-joint for malignant tumour of the arm, 3 recovered and 1 died ; of 3 amputations at the lower third of the thigh for malignant tumour of the tibia, all recovered ; and of 3 cases of amputation at the hip-joint, 2 recovered and 1 died. The fatal case of amputation at the shoulder was that of a boy whose friends had declined to permit amputation two years previously, and who as strenuously urged its performance when the tumour had involved the soft parts, and when repeated hæmorrhage had so exhausted him that I performed the operation only under protest. In regard to the hip-joint, the two successful cases were examples of malignant tumour developed in the femur, and they both made excellent recoveries, although they were much exhausted at the time of the operation. The unsuccessful case was one of cancerous tumour of the soft parts. The patient had declined interference eighteen months previously, and the tumour had increased greatly, with marked cachexy, at the time of the operation.

If, therefore, we exclude these two cases, and confine our observation to malignant tumours limited to the bone, all the cases of that kind in which amputation was performed beyond the affected bone recovered, whilst in those where amputation was performed through the continuity of the affected bone, 6 out of 11 died. Amputation at the hip I believe is really attended with as little if not less risk in its performance than even amputation through the trochanters ; and, whilst it affords the best chance for complete removal of the disease, it is also attended in most cases with a better chance of recovery from the operation. At the same time, when the tumour is limited to the condyle of the femur, I think that in the early stage amputation above the middle of the thigh is sufficiently safe, as in none of the four

successful cases alluded to has the disease returned, though several years have passed since the operations were performed.

Amongst the miscellaneous cases of amputation, whilst some of them possess features of individual interest, they suggest but little in regard to general principles. I would merely notice the case of amputation for gangrene arising from diffuse popliteal aneurism, as one of those which, I think, unfairly swell the mortality of amputation statistics. So far as regarded the amputation, no case could have progressed more favourably, the stump had nearly healed, and the patient was sitting up in bed when he died in an instant from rupture of an aneurism of the aorta into the pericardium, a condition totally unconnected with the amputation.

These general remarks on amputation have extended to greater length than I intended ; but before concluding, I would, to prevent misapprehension, recapitulate, in the two following statements, some points which I wish you to keep in mind :—

1st. In all ordinary cases the general rule holds good, that the smaller the amount of the body removed, the less will be the risk to life. But, in cases of primary amputation, where the bones are much comminuted or longitudinally fissured, I believe that amputation beyond the injured bone really diminishes the risk of pyæmia ; and that in cases of malignant tumours of the shaft of a bone, amputation beyond the diseased bone is distinctly indicated, as it not only affords the greatest chance of immunity from the disease recurring, but actually diminishes the immediate risks.

2d. That whilst, as a general method, I prefer a long and short flap, with a moderate amount of muscle, to form a covering for the bone, the muscular substance saved should never be great, as that adds to the risks of suppuration and pyæmia ; and the muscle should merely be preserved at that part of the flap corresponding to the end of the bone. But in all cases of amputation for injury or malignant disease, I consider that two equal

flaps of smaller dimensions, or the modified circular method, are attended with less risk of retaining diseased structure, or of being followed by sloughing or pyæmia, and that in such cases little or no muscular structure should be retained. The form of the stump must yield to the more important considerations of the complete removal of disease, and diminution of the risk to life.

LECTURE LXXXVII.

Special Amputations—The Upper Extremity—Amputation of the Distal Phalanx of Finger : of the whole Finger ; of Fingers and their Metacarpal Bones ; of the Thumb—Partial Amputation of the Hand—Amputation at the Wrist-Joint—Lines of Incision and form of Flaps—Amputation of the Forearm—By Double Flap—Teale's Method by transfixion.

THE general subject of amputation has now been fully discussed. It therefore only remains for me to consider, as briefly as possible, the SPECIAL AMPUTATIONS. I shall begin with those of the upper extremity.

AMPUTATION OF THE DISTAL PHALANX OF A FINGER is an operation which is seldom performed on the living body. In cases where the part is diseased, we generally wait until the bone has become loosened by exfoliation, and then separate it through a free longitudinal incision made in front of or at the side of the finger. By these means the digital extremity is saved, and a more satisfactory result obtained than could be by amputation. When the same part of the finger is injured by an accident to such an extent as to warrant its removal, the soft textures are generally so much destroyed as not to leave sufficient material for the formation of a flap to cover the end of the bone. The operation is one, however, which the student may practise, with advantage to himself, on the dead subject, as giving him neatness and dexterity in performing disarticulation.

In amputating the distal phalanx of the finger, we must keep in mind that the proximal end of the phalanx has a slight projection, which overlaps the articular end of the middle phalanx, when the finger is kept straight ; but when the distal

phalanx is flexed the relations of the bones are altered, and the articular end of the middle phalanx is then made prominent, and the ligamentous and other soft textures covering it, are rendered tense. In performing the operation, the surgeon grasps the extremity of the phalanx between his finger and thumb, flexes it as far as possible, and, with a narrow bistoury, cuts directly upon the projecting end of the middle phalanx, carrying his incision fairly across the posterior aspect of the joint, which is thus opened. He next, with the point of the knife, divides the lateral ligaments, so as to free the articular end of the distal phalanx and allow the blade of the knife to be passed in front of it. He then cuts a flap sufficient to cover the stump from the anterior aspect of the finger. Or the proceeding may be reversed when the joint cannot be bent. The surgeon then transfixes the soft parts in front of the joint, and cuts the flap; next opens the articulation from before, divides the short lateral ligaments, and disarticulates the phalanx by cutting backwards. When, owing to disease or injury, soft parts cannot be obtained to cover the end of the middle phalanx, we require to remove a portion of it, and with this view we must shape our flaps from the sound textures, and with the bone-pliers snip off a portion of the bone. If we are thus able to leave the attachment of the superficial flexor tendon, the stump so left will be useful; but when we have to amputate close to, or at, the articulation between the middle and proximal phalanges, it is better to amputate at the metacarpo-phalangeal articulation, as the short stiff stump left in the former case would be a deformity, and rather interfere with the use of the other fingers. The only case where it is sometimes advisable to amputate at the junction of the middle and proximal phalanges, is in the case of the forefinger, as the stump serves as a counterpoint to the thumb for prehensile purposes.

AMPUTATION OF THE FINGER at the metacarpo-phalangeal joint is performed thus:—An assistant holds the forearm and wrist firmly with one hand, whilst with the other he separates the fingers on either side of the one to be removed, and bends them

Fig. 1

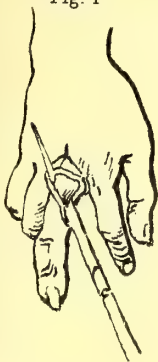


Fig. 2

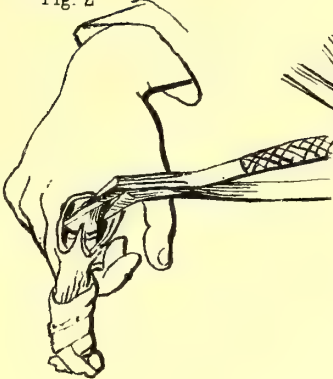


Fig. 3

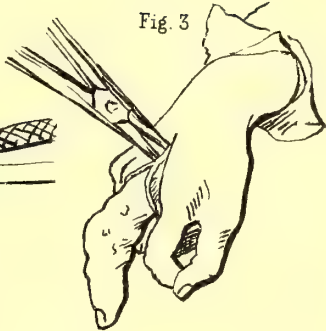


Fig. 4

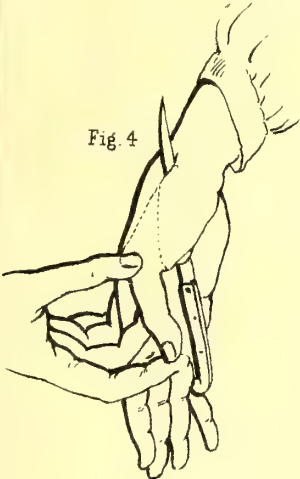


Fig. 5

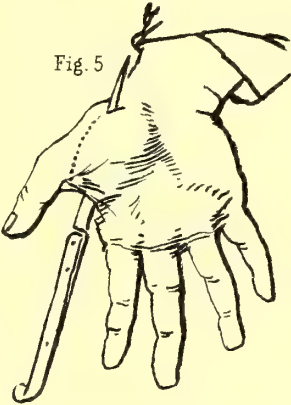


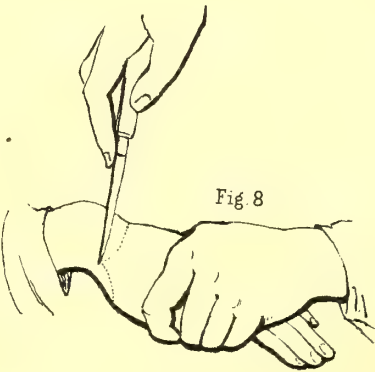
Fig. 6



Fig. 7



Fig. 8



so as to keep them out of the way. The surgeon, standing in front of the patient, seizes the doomed finger with his left hand, and uses it as a lever, to twist it in different directions to render the ligamentous textures tense over the articular end of the phalanx, so as to effect their division more readily. The point of the knife is then placed over the middle line of the metacarpal bone, at least half-an-inch higher up than the joint. The incision is carried straight down, till near the web between the fingers, when it is made to diverge slightly to one side of the finger, and carried fairly down into the palm, in an oblique direction, converging again towards the middle line; from this point it again diverges towards the web, on the opposite side of the finger, and is then made to pass upwards, converging to and terminating in the original incision on the dorsal aspect of the hand. The extensor tendon, capsular and lateral ligaments, are then divided, and disarticulation having been thus effected, the surgeon draws down and extends the finger, and removes it by dividing the flexor tendons at one sweep of his knife. The result is a V-shaped incision, which, when the fingers are approximated, forms a single linear cicatrix. The digital arteries require to be secured, and a point or two of suture introduced, to close the wound. When the oval method is adopted, the incision is brought round the root of the finger without cutting into the palm; but this results in a puckered projection—an unseemly appearance, which is avoided by the V-shaped incision. The operation may also be performed with the same result by the method represented in Plate xxxv. Fig. 1. The hand being held as before, with the fingers well separated, the surgeon lays the edge of a long narrow bistoury against the tense web close to the finger, and cuts into the joint, and by a rapid movement causes the heel of the knife to cut the palm, and the point of the knife to divide the skin on the dorsal aspect higher up beyond the joint, twists the finger so as to divide the lateral ligaments, pushes the articular end of the phalanx aside, to allow the knife to pass round it, and completes the operation by cutting through the web of the fingers

on the opposite side to where he began his incision. This latter method, though simple and rapidly effected, requires practice, to avoid cross-cutting in rounding the end of the bone to cut outwards. By whatever method the finger has been amputated, care should be taken to preserve the parallelism of the contiguous fingers ; and for this purpose I always introduce an elongated pad of lint between the fingers, extending from the points to the articulation of the middle with the proximal phalanx. This prevents their being dragged too closely together, and so impairing the usefulness of the hand. The less dressing over the incision, the better.

The mere cartilaginous head of the metacarpal bone may be removed without injury, as some think this facilitates the healing of the wound, although, for my own part, I think it better to leave it on. But unless disease or injury compel us, on no account should the broad portion of the metacarpal bone beyond the head be removed in the case of the middle or ring fingers. It is sometimes advised as leaving a neater hand ; but it is quite inadmissible on such a plea. That portion of the bone forms the keystone of the metacarpal arch, and its removal permits the other metacarpal bones to fall inwards, and so the usefulness of the hand is impaired. In the case of the little or forefinger, which are placed laterally, the objection does not exist, and the oblique section of their metacarpal bones beyond the articulation obviates deformity. In the case of the forefinger, the usefulness of the hand is increased rather than impaired by the procedure, as then the middle-finger takes the place of the forefinger in relation to the thumb, more easily than when the projection of the metacarpal bone is present. The method of removing the end of the metacarpal bone of the forefinger is shown in Plate xxxv. Fig. 2. The incision of the soft parts is similar to that already described, only placed to the side, so that the cicatrix may be less observable. The section of the bone is best effected by the oblique cutting bone-pliers.

In amputation of a finger, along with a portion of its metacarpal bone, the incision is commenced half-an-inch above the

point at which we contemplate dividing the bone, and is carried down along the middle line of bone till it reaches the web of the finger, where it diverges to form the V-incision, as in amputation at the metacarpo-phalangeal joint. The extensor tendon is cut across, and the metacarpal bone cleared from the soft parts attached to its sides. Its section is then accomplished by Liston's bone-pliers. They should be applied perpendicularly, with their smooth surface towards the part to be left. When the bone is divided, the end is raised by means of a hook or forceps, and with the point of the bistoury cutting upon the bone, we clear its palmar surface with the least possible interference with the structures in that region, dividing the flexor tendons as we cut out at the web between the fingers. Thus the palm is scarcely touched, and a comparatively superficial wound results. Formerly, when the metacarpal saw was used, the whole thickness of the palm was necessarily divided to permit of section of the bone. When the little finger is the subject of this operation, the incision is made on the ulnar side of the hand to avoid deformity, not on the back. Disarticulation of the fingers at the carpo-metacarpal joint should never be performed if we can leave even the small portion of the metacarpal bone, because, by opening any one of the articulations here, there is communication with the whole range, and inflammation of these irregular articulations is very apt to occur, and serious consequences, both local and general, may follow. In some cases, as for malignant tumours of a metacarpal bone, we may be obliged to disarticulate. In removal of the little finger, with its metacarpal bone, the incision of the soft parts is made along the ulnar aspect of the bone ; and in disarticulating, the knife passed between it and the fourth metacarpal bone, should have its edge turned towards, and be made to cut upon that metacarpal bone, as the articulation is oblique, and division of the strong interosseous ligament is most readily effected in this way, and disarticulation is then easily accomplished.

AMPUTATION OF THE THUMB.—Amputation of the distal

phalanx, or at the joint between the proximal phalanx and the metacarpal bone of the thumb, is performed in the same way as in the fingers ; but the usefulness of even a small portion of the thumb is so great that it is important to save parts of the phalanges by irregular operations which we would not think of performing on the fingers. Amputation of the thumb, along with its metacarpal bone, is therefore avoided except in cases of dire necessity. When, however, disarticulation is required, it is not obnoxious to the risks incurred in amputating the other metacarpal bones at their junction with the carpus, for the os trapezium, with which it is articulated, lies on a plane anterior to, and does not implicate the other carpal joints.

The amputation may be performed in various ways. The best plan is by the V-shaped incision, either made by cutting from the skin, as in the case of the fingers, or partly by transfixion, and partly by incision from without (Plate xxxv. Figs. 4, 5, and 6). The latter method is more rapid and elegant in execution, and gives the same result. Suppose the left thumb is to be removed. The surgeon grasps its extremity with the forefinger and thumb of his left hand, inserts the point of a long bistoury on the dorsal aspect of, and about half-an-inch above, the carpo-metacarpal joint, and carries the blade obliquely over and towards the ulnar side of the metacarpal bone, with a bold and decided sweep, so as at once to divide the parts forming the web between the thumb and index finger. Next, without withdrawing the point of the bistoury, he bends forward the thumb, as represented in Fig. 4, Plate xxxv., so as to relax the muscles forming the ball of the thumb, passes his knife in front of the metacarpal bone, brings its point out at the first incision, and turns its edge almost directly towards the skin ; pushes the thumb outwards, as in Fig. 5, to render the parts tense, and cuts toward the surface ; then, forcibly throwing back the thumb, he opens the joint between the trapezium and metacarpal bone of the thumb, and completes the disarticulation. If the right thumb is to be amputated, the surgeon begins by transfixion, and completes his palmar flap or incision ; and then, applying the heel of

the knife to the web of the thumb, carries the blade rapidly through the soft parts on the dorsal aspect, terminating in the first incision at the upper point of transfixion, and concludes by disarticulating, as in the former case. By this method the amputation can be performed with great rapidity, and without withdrawing the knife from the incisions till they are completed. The appearance of the elliptical wound left after disarticulation is shown in Fig. 6, Plate xxxv., and the result after the wound has healed is a simple linear cicatrix.

PARTIAL AMPUTATION OF THE HAND is generally required for injury, and consequently the operative procedure must vary in each case, according to the amount and direction of the destruction of parts. Under certain circumstances it may be performed by means of a large flap from the palmar aspect ; the metacarpal bones being removed, or sawn through close to the carpal articulation, and the thumb preserved, as represented in Plate xxxv. Fig. 7, or by two smaller flaps anterior and posterior. In many cases we must construct the best covering we can by shaping the sound portions of the soft textures, to adapt themselves to the surface of the stump. In all cases where we can save a finger, or a portion of a finger, as an opponent to the thumb, it is most important to do so ; but even when the thumb and a portion of the hand can be saved, it should be done, as an artificial opposing power can be fitted to the stump. If, however, the carpo-metacarpal joints of the fingers, and that of the thumb, be injured, and its long flexor tendon torn, there is little use, and considerable risk, in attempting partial amputation, as the movement of the parts would be lost, and unhealthy inflammation and suppuration very likely to occur. Amputation at the wrist, under such circumstances, would be the better plan. Whenever we can avoid opening into the carpo-metacarpal articulation, we ought to do so, for reasons already given.

AMPUTATION AT THE WRIST affords excellent results in suitable cases, but these are not of common occurrence. The object

in performing this operation, instead of amputating higher up, is not to get a longer stump, but with the view of retaining the movements of pronation and supination, and consequently the greater use of the stump. To obtain this advantage, the lower radio-ulnar articulation must be sound. Hence there is no use in performing this amputation in cases of disease of the wrist-joint, as in such cases, where amputation is warranted, the lower radio-ulnar articulation is almost always implicated, and we obtain a better stump by amputation of the forearm. The cases suitable for amputation at the wrist are those of injuries in which no part of the hand can be saved, but where the lower radio-ulnar articulation is intact, and where we can obtain sufficient flaps of sound skin to form a covering for the stump. I have performed the operation with very successful results in several such cases. The modified circular method is in my opinion preferable to a flap saved from the palmar aspect, as sometimes recommended. In performing the operation, the assistant who holds the forearm should draw up the integuments tightly. The surgeon then makes a slightly curved incision, with its convexity downwards, on the dorsum of the wrist. This incision should begin about an inch below the styloid processes of the ulna and radius, and should join, with a gentle curve, a similar incision carried over the forepart of the wrist. These incisions should divide the skin, fat, and fascia; and a few touches with the knife enable the assistant to retract the loosened integuments to a level with, or a little above, the styloid processes. The flexor and extensor tendons are rendered tense, and divided with a circular sweep of the knife below that point. The joint is then opened by dividing the lateral ligament on the outer or inner side, as most convenient for the operator, and disarticulation accomplished from behind forwards. By following this plan, we find that when the operation is completed the flaps come well over the ends of the bones, which are covered with sound skin; whereas, in the ordinary flap method, the styloid processes correspond to and tend to project at the angles of the incisions where the bases of the flaps unite. The vessels requiring ligature, in this opera-

tion, are the radial and ulnar ; sometimes, but rarely, the terminal twigs of the interosseous artery. During the after-treatment, the forearm should be placed in the position between pronation and supination.

AMPUTATION THROUGH THE FOREARM may be performed by the double-flap method, by transfixion, by cutting the flaps from without inwards, so as to avoid redundancy of muscle, or by a long and short flap on Teale's principle. By any of these methods an excellent stump can be obtained, and our choice is often regulated by the conditions demanding the operation. In all cases of primary amputations, the plan of cutting our flaps from without inwards answers best ; it enables us to shape the flaps more regularly, to avoid injured tissue, and to leave only a very moderate amount of muscular and tendinous structure in the flaps. If we operate by transfixion in such a case, the tendons and muscles loosened from their connections by the injury yield, and are dragged out before the knife and cut irregularly, leaving a redundancy of muscle and ragged surface. In operating, we shape two equal rounded flaps from the anterior and posterior aspects of the forearm, dissect the integuments, fat, and fascia, upwards for at least two inches. the assistant retracting the skin. Then the muscles are divided obliquely upwards to the bone, leaving only a small quantity of muscle on the anterior aspect ; the knife is swept round and between the bones, the flaps retracted, the bones sawn through, and the operation completed by securing the vessels, and bringing the flaps into apposition by sutures. When the operation is undertaken for disease, the muscular tissue is generally atrophied and not likely to be redundant, and the tendons being attached inferiorly, the flaps can be cut smoothly and evenly by transfixion, and without disturbance of the natural connection of parts. In performing the double-flap operation by transfixion, the arm being held between pronation and supination, the surgeon grasps the soft parts covering the sides of the forearm, and draws as much of them as possible towards the

posterior aspect of the limb, so as to obtain as broad and bulky a posterior flap as possible. He then transfixes the base of his flap from the radial towards the ulnar side of the limb, and in the case of the right forearm, from the ulnar towards the radial side of the left forearm, making his knife pass close to the posterior surfaces of the bones, and then carries it down so as to cut out a gently-rounded flap about $2\frac{1}{2}$ or 3 inches long. Again he inserts his knife in front, about half-an-inch lower than the former point of transfixion, and cuts a flap to correspond with the posterior one. Both flaps are then forcibly retracted, the knife applied so as to clear the bones at least an inch higher than the point of transfixion, the interosseous textures divided, the bones sawn through, and the operation completed as in the former method. Or the operator may make his second flap by cutting from the skin inwards. In either case, to facilitate the formation of the anterior flap, the assistant should supinate the forearm when the posterior flap is completed. In my own practice, I generally cut the posterior flap somewhat longer than the anterior (as represented in Plate xxxvi. Fig. 1), so that it may fold over the ends of the bone as the wound heals, and thus the cicatrix does not correspond to the end of the bones. The reason why the knife is entered lower down in transfixing for the second flap is to avoid cross-cutting the base of the first flap, which is otherwise almost certain to occur.

Amputation of the forearm by a long and short flap on Teale's principle, can be most readily performed as follows :—The forearm being held as formerly described, or slightly supinated, the surgeon, managing the soft parts as in the former case, transfixes in front of the bones, and carries his knife directly down close to the bones, without any inclination to the surface, for about four inches, he does not cut out at this point, but, drawing the knife back in the track of the incision for about two inches, turns its edge directly towards the surface, and cuts out there, so as to form a short square flap; then at the point where the longitudinal incision terminated he divides all the soft parts on the back part of the forearm with a decided circular sweep of his

knife, and separates the long square flap so marked out rapidly up to its base. The bones are then cleared and sawn through, and the operation completed, care being taken to adjust the angles of the flaps exactly to each other.

The vessels which require to be secured after amputation of the forearm are the radial, ulnar, and interosseous. The two first are easily seen and secured. The radial lies very superficial and to the outer side of the anterior flap. The ulnar is deeper, and in muscular limbs sometimes retracts a little, but the position of the ulnar nerve at once guides to the vessel. The posterior interosseous and its branches are seen on the posterior flap, but the anterior interosseous, which lies deep, is sometimes difficult to secure, as it retracts amongst the deep muscles. It should always be looked for and secured, as it may cease to bleed at the time of the operation, but is sure to bleed and give rise to trouble afterwards. In this operation, and indeed in all amputations, the nerves should be drawn out a little, and cut short, so as to prevent them becoming adherent over the bone, or in the cicatrix, as shown in Plate xxxiii. Figs. 1, 2, and so giving rise to a painful stump.



LECTURE LXXXVIII.

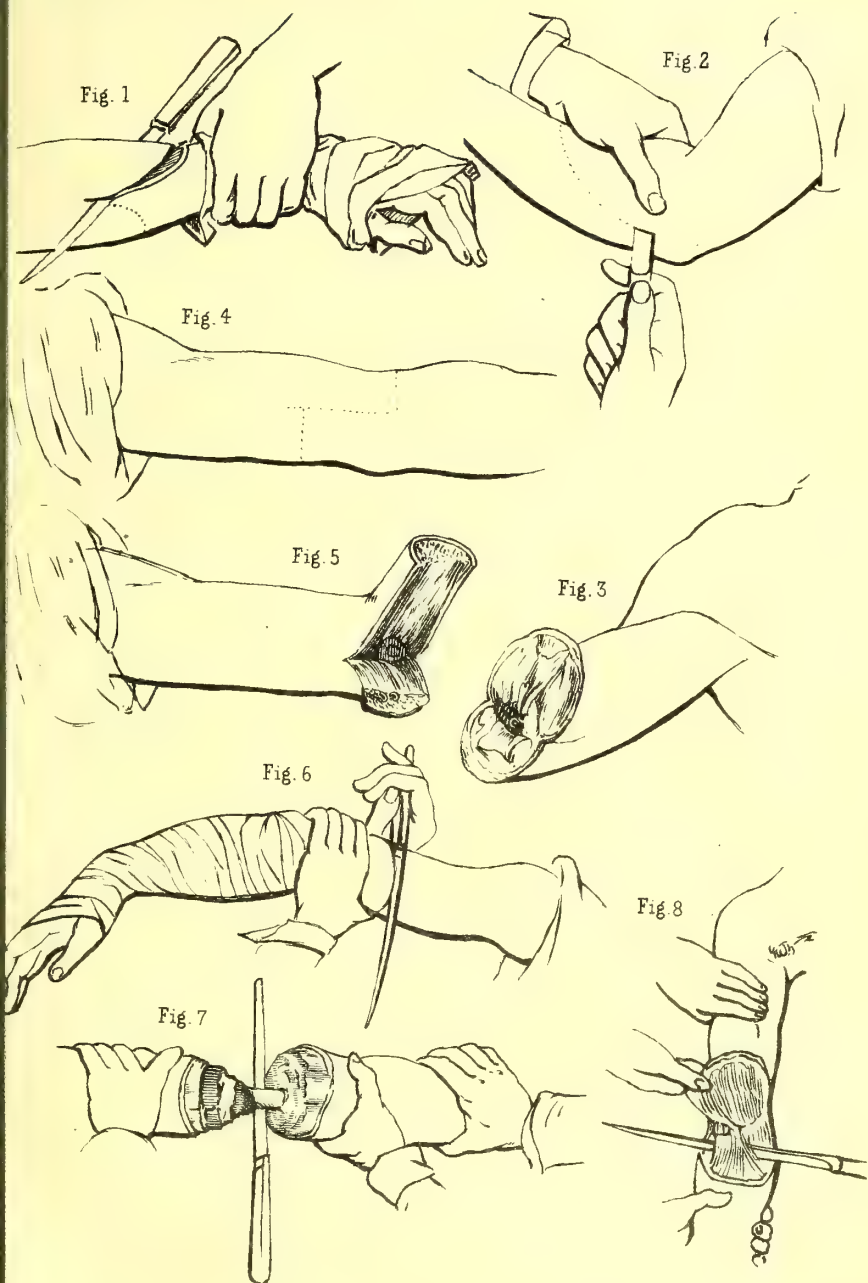
Amputations in the Upper Extremity *continued*—At the Elbow-Joint—Amputation of the Upper Arm by the Circular Method : by the Antero-Posterior and Lateral Flap Methods—Teale's Method—Amputation at the Shoulder-Joint : by a large Deltoid Flap ; by Double-Flap Method—Advantages and Disadvantages of each — The Author's own Method : its Advantages — Details of his mode of conducting the Operation—Amputation of Arm and Scapula.

AMPUTATION AT THE ELBOW-JOINT is seldom performed, because in the cases where it would be desirable we can rarely get a sufficiency of sound texture to form a covering for the large condyloid end of the bone. In a case in which I operated for the effects of an old burn, I had to form a long flap from the soft parts on the outer side of the forearm, and a flap from that position, or from the inner side, may occasionally be obtained in cases of recent injury, to enable us to get a covering. The preferable method, when we have the choice, is to cut a long flap from the anterior aspect of the joint, and a smaller one posteriorly, either by transfixion immediately below the condyles, and cutting towards the surface so as to form a long flap, as represented in Fig. 2, Plate xxxvi., and then dividing the soft parts on the back by a circular cut ; or by cutting a similar flap from the surface inwards, then opening the joint in front, dividing the lateral ligaments, and separating the attachment of the triceps to the olecranon process, so as to complete the removal of the forearm. The result of this method is shown in Plate xxxvi. Fig. 3. When the arteries are secured and the nerves cut short, the anterior flap folds over the condyles, and is easily maintained in position.

AMPUTATION OF THE UPPER ARM is perhaps the simplest of

AMPUTATIONS.

Plate XXXVI

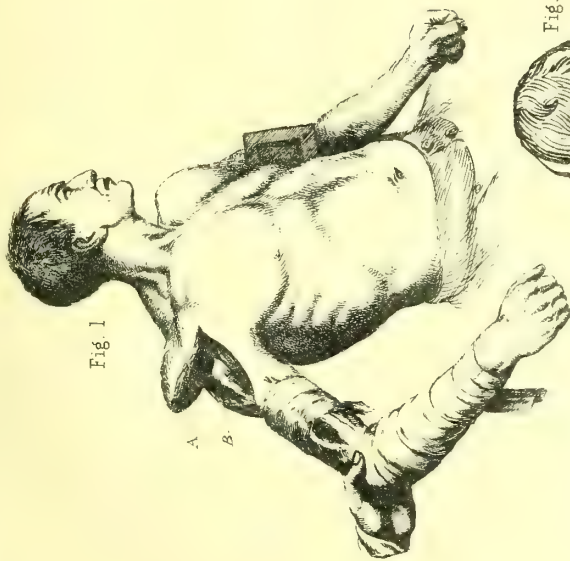


all amputations. It may be effected with almost equal success by the old circular or the modified circular method, or by antero-posterior or lateral flaps. In performing the circular operation (Plate xxxvi. Figs. 6 and 7), the integument should be well drawn up by an assistant. The operator should then bend his right knee, place his hand and wrist well round the arm, and begin his incision in such a position that, by rising and cutting simultaneously, he can cause the cutting edge of the knife to traverse the circumference of the arm at one sweep. The skin, fat, and fascia, so cut, should then be retracted by the assistant, and the muscular and other textures cut through to the bone by a second circular cut. These should in their turn be drawn upwards, the muscles immediately surrounding the bone projected, and the edge of the knife applied obliquely, so as to convert the projection into a hollow cone. The soft parts are then held back so as to allow the bone to be sawn as high as exposed. Thus, when the soft parts are restored to their position, they form a hollow cone, of which the section of the bone forms the apex. When healed, the result is a well-covered and very useful stump. The antero-posterior or lateral-flap method is performed by means of transfixion (Plate xxxvi. Fig. 8). The soft parts should be grasped and pinched up by the left hand of the operator, so as to enable him to transfix with the blade of the knife close to the bone. He should then cut downwards and outwards through the muscles and skin, making a well-proportioned and neatly-rounded flap. After that has been effected, he should re-insert the knife half-an-inch below the former point of transfixion, close to the bone on the opposite side, and make a second flap to correspond exactly with the first. The flaps should be well retracted, and the bone cleared and cut at a point at least an inch and a half above the angles of the incisions, and the bone sawn through there. All further retraction must then be avoided, lest the periosteum be dragged up from off the divided bone. Many surgical authorities seem to consider it a matter of indifference whether this amputation be performed by antero-posterior or lateral

flaps. My own experience leads me to a different conclusion. I think that whenever the upper arm is to be amputated at or near the middle, the method by lateral flaps (external and internal) should be adopted in preference to flaps from the anterior and posterior aspects of the limb. In the former, the line of the base of the external flap crosses the line in which the divided humerus is raised by the action of the deltoid, and consequently the flap folds over the bone as it is raised. But if we adopt the antero-posterior flaps, the line of union of the flaps corresponds to that in which the end of the bone will be raised after section, and hence it is liable to be projected at the angle of incision. In fact, the lateral-flap method in this region has the same advantage that the antero-posterior flaps have in regard to amputation in the thigh.

Teale's method (Plate xxxvi. Figs. 4 and 5), by a long external and very short internal flap, answers admirably in cases of disease of the forearm, in which the muscles of the limb are atrophied, or the textures condensed by inflammatory exudation. I have performed it in several such cases with excellent results. The following is the method:—I grasp the soft parts on the outside of the arm, about four inches above the external condyle of the humerus, so as to separate them from the bone, and transfix there, taking care to include fully half the circumference of the limb, and then carry the knife downwards parallel to the bone, without inclining it in any direction, until it arrives at the condyle, when I turn its edge at a right angle to the skin and cut directly outwards, the assistant at the same time drawing up the skin. This long square flap is then held aside, and the soft parts on the inside of the arm divided with a single circular sweep of the knife, about an inch and a half below the point of transfixion, so as to form a short square flap, which is rapidly separated from the bone up to the base of the long flap. Both flaps are then retracted, and the bone cleared and sawn through about an inch higher up. The vessels are then secured, the nerves cut short, and the flaps carefully adjusted.

AMPUTATIONS.



AMPUTATION AT THE SHOULDER-JOINT may be performed by various methods. The two which have hitherto been generally adopted are—amputation by a large deltoid flap, and that by two lateral flaps.

Amputation by a large Deltoid Flap consists in cutting, either by transfixion or from without inwards, a large flap, including nearly the whole of the deltoid muscle, the arm being somewhat abducted to enable the surgeon to grasp and cut the flap more easily. The flap is then raised towards its scapular attachments, so as to expose the joint (Plate xxxvii. Fig. 1). The assistant then pushes the arm forcibly across the body, so as to render prominent the head and tuberosities of the humerus. The surgeon cuts directly upon the tense capsule and tendons of the capsular muscles, so as to open the articulation; rotating the arm outwards and inwards to divide thoroughly any resisting fibres of the external rotator or subscapularis tendons, turns out the head of the bone from its socket, and passes the knife on the inner side of the bone to divide the soft textures in the axilla, and form a short flap to meet the deltoid. As the surgeon cuts out, the assistant grasps the lower flap between his fingers and thumb, so as to command the axillary vessels before they are divided (Plate xxxvii. Fig. 2).

The *Double-Flap* method consists in forming, either by transfixion or rapid dissection, two nearly equal and gently rounded flaps, one from the posterior, the other from the anterior aspect of the shoulder. When transfixion is adopted, the patient is brought close to the edge of the table and turned on his side. The affected limb is held somewhat abducted by the assistant, who stands on the opposite side of the table. If the left arm is to be removed, the surgeon introduces his knife from the posterior border of the axilla, passes it obliquely upwards over and close to the head of the humerus, and brings out the point opposite the centre of the acromion process, and cuts downwards so as to form a rounded posterior flap (Plate xxxvii. Fig. 3). The flap being raised, exposes the outer surface of the joint, the assistant draws the arm across the chest so as to project the head of the humerus,

and the operator divides the capsule and capsular tendons, disarticulates, and then places his knife on the inner side of the bone (Plate xxxvii. Fig. 4) and cuts the anterior flap. If the right limb is to be removed, the knife is introduced from under the point of the acromion, passed over the head of the humerus, and brought out at the posterior margin of the axilla to form the posterior flap. The vessels are commanded and the operation completed as already described.

This plan of operating is that generally adopted; for although the deltoid flap makes an excellent covering, and admits of great facility in disarticulation, yet the amount of exposed cut surface and the double line of cicatrix contrast unfavourably with the single central linear scar left by the double-flap method. Moreover, the great length of tissue required in the deltoid flap cannot often be obtained in cases requiring amputation at the shoulder.

As regards the method by double flap, if we look at the result of such an amputation when recently performed, especially if executed by cutting the textures from without inwards, nothing can look better;—the two flaps joining neatly in their central line, and sufficiently full to give roundness and to fill up the space under the acromion. But if we look at such a stump some time after the healing process has been effected, the form of the stump will be found much altered, not merely from atrophy of texture common to all stumps, but from retraction of the muscular constituents of the flaps. The fibres of the pectoralis major retracting towards the sternum, and those of the latissimus dorsi and teres major towards the scapula and spine, cause a separation, especially at the lower part of the line of union, and give rise to the formation of a deep ugly hollow under the acromion, as seen in the adjoining woodcut (Fig. 1).

In 1856, from a perusal of Professor Langenbeck's and M. Baudens' memoirs on excision of the shoulder for gunshot wounds, I was induced to adopt the method of excision by a single linear incision made down upon the head and neck of the humerus, beginning immediately external to the cora-

coid process, instead of the V-shaped incision then practised here. In performing the operation on the living subject, I was struck, not only by the ease with which disarticulation could thus be accomplished, but also by observing that, from the deltoid being divided so far forward, there was no trouble with bleeding from the trunk of the posterior circumflex artery, which in other methods is always divided and often proves troublesome. In demonstrating the operation to my class at that time, I pointed out that it possessed another advantage—namely, that if, in

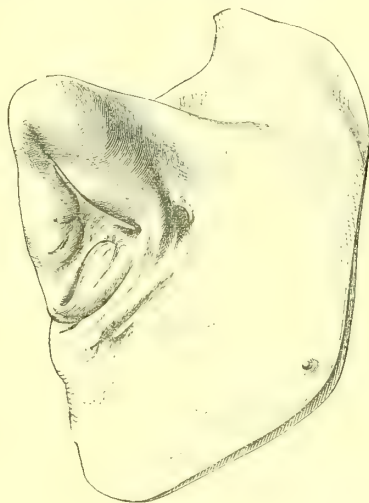


Fig. 1.

proceeding to excise the head of the humerus, the injury or disease were found to be more extensive than anticipated, we could form—by simply carrying the incision back towards the posterior fold of the axilla, as I then expressed myself—a very tolerable stump. But when, after performing the excision, I completed the demonstration by converting the excision into an amputation, it struck me that the result would be even better than that of the ordinary method. Accordingly I determined to adopt it on the first suitable case which I met with.

Some short time afterwards two cases of injury were sent to my care requiring amputation at the shoulder: one the result of a railway accident, shattering and tearing the upper arm; the other, a gunshot wound shattering the tuberosities and shaft. In these two cases I carried out the plan, and the result was so perfect in both that I have always since resorted to it in every instance where the nature of the case admitted of its performance. Indeed, the only instances in which I could not perform it have been two: the one a case of se-

condary amputation for a burn, in which, from the state of the textures, I was compelled to form the flap entirely from the front; and the other a case requiring amputation from the presence of a malignant tumour, to which the skin was adherent, and where only two very small flaps could be obtained from the sound textures.

What I have already said might almost indicate the method proposed. But to describe it more distinctly and fully.—Supposing the right arm to be the subject of amputation. The arm being slightly abducted, and the head of the humerus rotated outwards, with a broad strong bistoury I cut down upon the inner aspect of the head of the humerus, immediately external to the coracoid process, and carry the incision down through the clavicular fibres of the deltoid and pectoralis major muscles, till I reach the humeral attachment of the latter muscle, which I divide. I then with a gentle curve carry my incision across and fairly through the lower fibres of the deltoid towards, but not through, the posterior border of the axilla. Unless the textures be much torn, I next mark out the line of the lower part of the inner section by carrying an incision, through the *skin and fat only*, from the point where my straight incision terminated, across the inside of the arm, to meet the incision at the outer part. This ensures accuracy in the line of union, but is not essential. If the fibres of the deltoid have been thoroughly divided in the line of incision, the flap so marked out, along with the posterior circumflex trunk, which enters its deep surface, can be easily separated from the bone and joint, and drawn upwards and backwards so as to expose the head and tuberosities, by the point of the finger, without further use of the knife. The tendinous insertions of the capsular muscles, the long head of the biceps, and the capsule, are next divided by cutting directly on the tuberosities and head of the bone; and the broad subscapular tendon especially, being very fully exposed by the incision, can be much more easily and completely divided than in the double-flap method. By keeping the large posterior flap out of the way by a broad copper spatula or the fingers of an assistant, and taking care to keep the edge

AMPUTATIONS.

Plate XXXVIII

Fig. 1

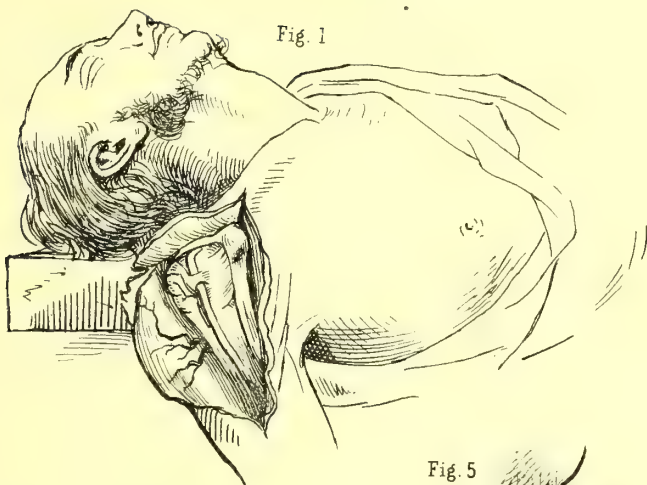


Fig. 5



Fig. 2

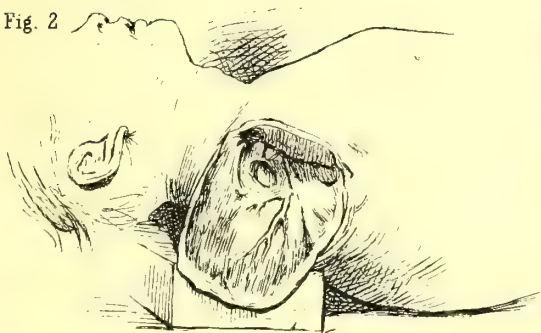


Fig. 4

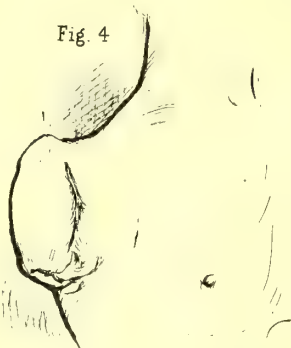
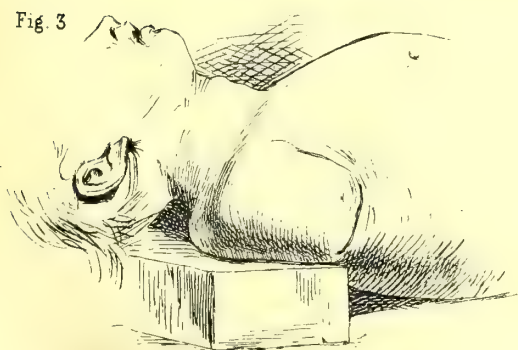


Fig. 3



of the knife close to the bone, as in excision, the trunk of the posterior circumflex is protected. The only vessel which bleeds is the anterior circumflex divided in the first incision, and, if necessary, a pair of catch forceps can be placed on it at once. In regard to the axillary vessels, they can either be compressed by an assistant before completing the division of the soft part on the axillary aspect ; or, to avoid all risk, the axillary artery may be exposed, tied, and divided between two ligatures, so as to allow it to retract before dividing the other textures.

In cases where the limb is very muscular, I dissect the skin and fat from the deltoid at the lower part, and then divide the muscular fibres higher up by a second incision, so as to avoid redundancy of muscular tissue. After arresting bleeding, I bring the edges together with a few points of suture, leaving an opening at the lower and back part, through which the ligatures are brought out and the free escape of blood and other discharge permitted.

The dressing I use is very simple, being merely a flat pad of lint secured by a six-tailed split cloth, the tails being tied on the opposite side of the body.

The advantages I claim for this plan are—1st. The fulness and better form of the stump left after the healing, as shown in the results (Fig. 2). 2d. The posterior circumflex artery is not divided except in its small terminal branches in front ; whereas, both in the large deltoid flap and the double-flap methods, the trunk of the vessel is divided in the early steps

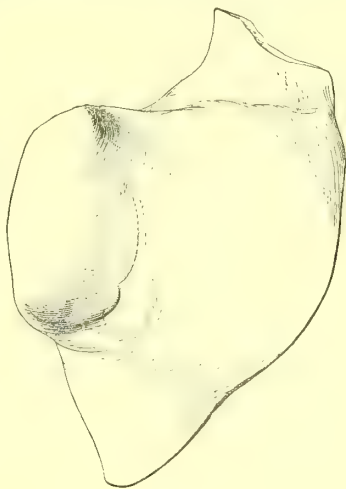


Fig. 2.

of the operation, and, retracting, often gives rise to embarrassing hæmorrhage. In the case of the deltoid single-flap method, the vitality of the flap must be seriously compro-

mised, as it depends chiefly on that vessel for its arterial supply. 3d. The great ease with which disarticulation can be accomplished.

In advocating the merits of any particular plan of operation, we should be careful not to risk its reputation by claiming superiority for it, under all conditions, over every other plan, or ignoring its disadvantages in certain circumstances. There are cases in which I would prefer the operation by double flap, such as those for malignant tumour, where we wish to remove all the muscular tissue of the deltoid, and leave nothing but skin-flaps. In these cases a single long flap dissected from the subjacent tissues, and depending entirely for nourishment on the vascular supply of its base, is more apt to slough than two smaller ones would be.

I may say, however, after considerable experience in amputation at the shoulder-joint, that there are few cases in which the method I have recommended will not be found suitable; and where it is so, I have no hesitation in advising it as being preferable to any other method I have ever practised.

AMPUTATION OF THE SCAPULA along with the arm is sometimes required in consequence of injury, or for tumours involving both the scapula and humerus, and the results of the cases in which it has been performed fully warrant it. In cases where the operation is necessitated, the surgeon must often require to modify his incisions, according to the position and connections of the disease, or the state of the injured parts. As a general rule, however, the operation is performed by dorsal and pectoral flaps from the axilla, to cover in the exposed surface. The posterior flap is marked out by making a lunated incision with its convexity directed forwards, commencing along the upper margin of the scapula and passing down over the acromion process to the lower border of the axilla, and again passing back towards the lower part of the base of the scapula. The anterior flap is next marked out by an incision commencing over the clavicle, about an inch nearer the sternum than the coracoid process of the scapula, and carried down over the front of the axilla to

its lower border, but there is no necessity for carrying this lower part of the incision towards the sternum further than to curve it slightly. The posterior flap is then to be dissected rapidly back, so as to expose the base of the scapula. The operator should then divide the integuments and humeral attachments of the pectoralis muscle in the line marked out for the anterior flap, and clear and saw through the clavicle on the sternal side of the coraco-clavicular ligament. This will enable him by a few touches of the knife to expose the axillary and supra-scapular vessels, and he can secure them at once, either by the assistant grasping them between his fingers, or, better, by tying them with double ligatures and dividing them. By this procedure the hæmorrhage from the great vessels and the sub-scapular and supra-scapular branches will be avoided. The flaps now being held aside, the attachments of the trapezius to the scapula are divided. The scapula and arm are drawn outwards by the assistant, and the scapular attachments of the serratus magnus, rhomoid, and levator anguli scapulæ muscles being stretched, are severed by a stroke of the knife, and the operation completed. The artery of the base of the scapula will be now divided and require ligature. Some advise that when the base of the scapula is exposed by dissecting the posterior flap, the muscles attaching the scapula to the trunk should be divided, the arm and scapula thrown forwards, the clavicle sawn through or disarticulated, and the anterior flap formed in cutting out. I prefer the method I have described, specially as preventing loss of blood as far as possible, but also because the division of the scapular attachment of the serratus is more easily accomplished after the clavicle is sawn through, and the scapula drawn from the side. Removal of the scapula alone, for tumours, will be considered when treating of operations in the axillary region.

LECTURE LXXXIX.

Special Amputations *continued*—Lower Extremity—Amputation of the Phalanges of the Toes : of the Phalanges of the great Toe with or without its Metatarsal Bone—Partial Amputations of the Foot ; of all the Toes : Hey's Operation ; Chopart's Operation—Amputation at the Ankle : by Syme's Method ; by a large Internal Flap—Other Modifications.

THE amputations of the lower extremity are performed on the same principles as those of the upper, but require to be modified in respect of form, and uses of the part left. The dotted lines on the plantar and dorsal aspects of the foot in Figures 1 and 2, Plate xxxix., indicate the lines of incision generally adopted in amputation of the toes, and partial amputations of the foot.

AMPUTATION OF THE PHALANGES OF THE TOES may be necessitated by a variety of causes, such as injury, cario-necrosis, exostosis, onychia maligna ; or by the toe having become so distorted as to interfere with progression. In the last-mentioned condition I have frequently saved the toe by dividing the flexor or extensor tendons, and other resistant tissues, so as to straighten the toe ; but the after-treatment of such operations is often tedious and troublesome, so that amputation affords a more rapid cure and equally good result, so far as the use of the foot is concerned.

AMPUTATION OF THE TOE is, or should be, always performed at the junction of the phalanges with the metatarsal bone. The lines of incision, and the mode of procedure, are the same as in the corresponding amputation of the finger ; only we must recollect that the joint lies further removed from the web between the toes than the metacarpo-phalangeal joint of the fingers. The amputation is accomplished thus :—The point of the bistoury is

inserted over the middle line of the toe to be removed, half-an-inch above the joint, carried down, gradually diverging to one side as it approaches the web, and is carried through that into the sole of the foot. From the plantar aspect it is carried upwards, on the opposite side of the toe, converging into the original incision. The strong flexor tendons on the plantar aspect of the toe are divided, the lateral ligaments cut with the point of the knife, and disarticulation effected. When the bleeding is arrested, and the adjoining toes are closely approximated, the loss of the toe is scarcely perceptible. The key to easy disarticulation of the toe is complete division of the strong flexor tendons, and, to effect this at once, I extend the toe forcibly upwards so soon as the incisions of the soft parts are completed ; and this enables me to twist the toe so as easily to open the joint and divide the lateral ligaments.

In performing AMPUTATION OF THE PHALANGES OF THE GREAT TOE, we require to save all the integuments we can, to cover in the large distal extremity of the metatarsal bone, and with this view we take care not to make the incision diverge laterally till it has passed for some distance beyond the articular end of the proximal phalanx, or we even carry the incision directly down to near the middle of that phalanx, and then cut circularly round the toe, thus marking out two square flaps of skin. In either mode the internal flap requires to be dissected, the texture forming the web on the outer side divided, and then the flexor tendon cut, and disarticulation accomplished, as in the other toes. The sesamoid bones may require to be removed along with the phalanges. No part of the articular surface or extremity of the metatarsal bone of the great toe should be removed with a view to neatness of the stump, as it forms the anterior extremity of the antero-posterior arch of the foot, and its removal seriously injures both progression and the support which the arched form of the foot affords.

When injury or disease necessitates AMPUTATION OF THE META-

TARSAL BONE OF THE GREAT TOE, along with its phalanges, the longitudinal incision may be made either on the dorsal or internal aspect of the foot, and carried down to its phalangeal articulation, when it is made to diverge, as in the amputations of the phalanges. If partial removal of the bone is contemplated, its section is accomplished, at a healthy point, by means of strong bone-pliers. If disarticulation of the whole bone is necessary, then the incision must commence fully three-fourths of an inch above the articulation between the metatarsal with the internal cuneiform bone. The form of the articulation must be kept in mind. It is not broad, but very deep from the dorsal towards the plantar aspect of the foot, and is most easily opened by cutting the lateral ligaments on the inner side, then inserting the knife perpendicularly, with its edge directed upwards, between the first and second metatarsal bones, so as to divide the strong interosseous ligamentous structure. When this is done, and the great toe and its metatarsal bone forcibly drawn inwards, the disarticulation is most easily effected. Great difficulty has often been met with in arresting the bleeding after partial amputation of this metatarsal bone. This arises from the terminal branch of the dorsal artery being wounded, as it passes down between the first and second metatarsal bones to join the plantar arch. The vessel is wounded, not divided completely, and cannot be seized with the artery forceps, or, when seized, the ligature cannot be tightened in the narrow space between the bones. In some cases I have managed to pass a double ligature by means of an aneurism needle, drag the vessel up and secure it; but in one instance I had to disarticulate the remaining portion of the bone before the vessel could be secured above and below the wounded point, and this has been required in other cases; whilst there have been fatal results from repeated hæmorrhage, when compression has been trusted in to arrest the bleeding. For my own part, I see no great advantage in leaving a small portion of this metatarsal bone, as the articulation is on a line anterior to, and does not communicate with, the other tarso-metatarsal joints; and, when complete disarticulation is per-

AMPUTATIONS.

Plate XXXIX

Fig. 1

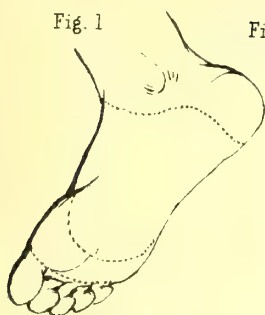


Fig. 2

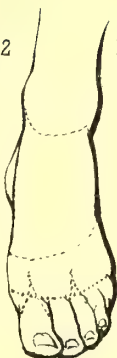


Fig. 3



Fig. 4

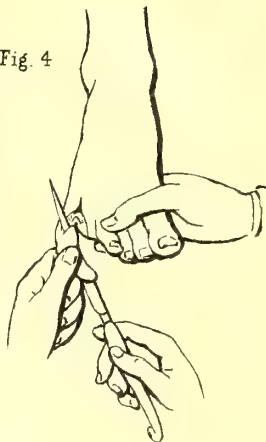


Fig. 5



Fig. 6

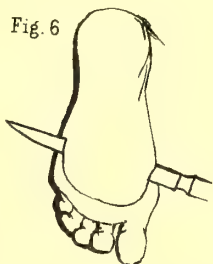


Fig. 7



Fig. 8



Fig. 9

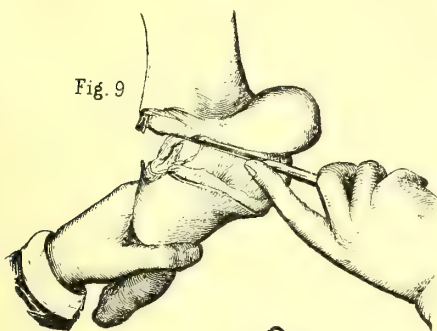


Fig. 10

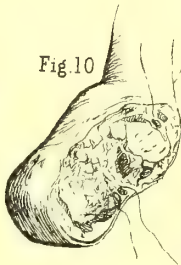


Fig. 11

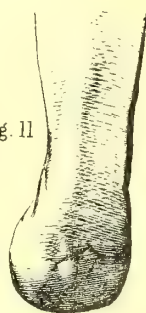
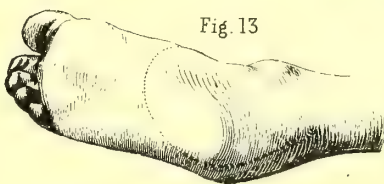


Fig. 12



Fig. 13



formed, there is no difficulty in seeing and dealing with the wounded artery.

PARTIAL AMPUTATION OF THE FOOT may be performed at different points, and, like the partial amputations of the hand, the operation must be modified according to the circumstances requiring its performance. But, besides the irregular amputations, there are certain amputations of the foot which may be considered as regular operations, such as, amputation of all the toes at the metatarso-phalangeal articulations, Hey's amputation at the junction of the tarsus with the metatarsus, and Chopart's amputation at the joint, between the scaphoid and cuboid, with the astragalus and calcaneum.

AMPUTATION OF ALL THE TOES, at their junction with the metatarsus, is best accomplished by shaping a short skin flap from the dorsal aspect of the joint, and a larger plantar flap, as represented in Plate xxxix. Fig. 5, and effecting disarticulation by opening the joints from the inner side of the left and the outer side of the right foot, after dividing freely the textures on their dorsal and plantar surfaces. Owing to the division of the digital branches, a great number of arteries require to be tied in this amputation.

Partial amputation of the foot, leaving the great and second toes, and removing the other toes with their metatarsal bones, or even removal of all the toes and metatarsus with the exception of the great toe, leaves a very useful foot. The flaps must be cut from without inwards, and must be so shaped that a large somewhat triangular flap from the plantar region is obtained to cover in the tarsal range and outer aspect of the metatarsal bone of the great toe, and a smaller dorsal flap to meet it. In two instances I have removed the two outer cuneiform bones and anterior surface of the cuboid, leaving the great toe; and when the wound was healed, and a well-stuffed boot worn, the movements of the foot, after a time, seemed as free as those of the opposite one. When the great and second toes require to be

removed, Hey's amputation is preferable to leaving the two or three outer toes, as they gradually curve obliquely inwards, and impede instead of assisting progression.

PARTIAL AMPUTATION OF THE FOOT AT THE TARSO-METATARSAL ARTICULATION was first proposed by Hey of Leeds. As performed by him, disarticulation of the metatarsus having been accomplished as far inwards as the internal cuneiform bone, the projecting part of that bone was sawn off, and the foot removed. Lisfranc's modification of the operation consists in disarticulation throughout the whole range of the articulations. It is advisable for the student to practise Lisfranc's method on the subject, so as to gain dexterity in disarticulation. But, in operating on the living, I would advise Hey's method, in respect that it is at once easier in execution, and leaves a better stump, by removing the projecting end of the internal cuneiform. The objection, that by doing so we destroy the attachments of the *tibialis posticus* and *anticus*, is merely fanciful. These tendons and their expansion are attached to the whole extent of the internal cuneiform bone.

As regards the incisions, they are the same in both methods. The surgeon grasps the foot with his left hand, placing his forefinger and thumb, the one well behind the projection of the metatarsal bone of the fifth toe, the other over the base of the metatarsal bone of the great toe, thus marking the general line of the articulation. He then cuts obliquely, from without inwards in the left foot, and from the opposite direction in the right foot, across the integument on the dorsum of the foot, an inch and a half in front of or below the articulation, and by a few touches of the knife frees it so that it can be retracted beyond the joint. Next he shapes a large flap from the plantar region. This flap should be longer on the inner than on the outer side, gently rounded off at its extremity, and should contain all the thickness of the plantar textures. Next, the operator disarticulates, by cutting from the fifth metatarsal bone inwards, until the knife is arrested by the head of the

second metatarsal bone. Instead of trying to get round that, he attacks the articulation between the internal cuneiform and first metatarsal, by opening it from the inner side. He then plunges his knife perpendicularly between the first and second metatarsal bones with its edge directed upwards, and moves it backwards and forwards till he feels the strong interosseous ligament give way. He then forcibly depresses the part to be removed, and, with a few touches over the head of the second metatarsal bone, the joint is opened, and disarticulation accomplished.

In Hey's method, after disarticulation is so far effected, the saw is applied to remove the projection of the internal cuneiform bone, and thus a more regular surface is left, and the operation much simplified. The plantar flap may be made by transfixion (as in Plate xxxix. Figs. 6 and 7); but I recommend it to be cut as I have described, as we can then shape it more accurately. The dorsal and plantar arteries require ligature, and also, in general, numerous branches springing from the arch. Some surgeons trust almost entirely to the plantar flap for a covering, but, to say nothing of the impossibility of always obtaining so long a plantar flap, I think it better that the cicatrix should be rather over the surface of the stump, where it will be opposed to the soft padding, than on the dorsum of the foot, where it will be exposed to the pressure of the boot.

Chopart's amputation consists in removal of that portion of the foot which lies anterior to the astragalus and os calcis. The general method of procedure and form of the flaps are very similar to that just described. The plantar flap requires to be very long internally, to fold over the exposed articular surface, which is very deep. The disarticulation, however, is very simple as compared with that at the tarso-metatarsal joint; for although, anatomically speaking, the line of articulation between the astragalus and scaphoid is slightly curved, and that between the cuboid and os calcis oblique from within outwards and forwards, yet practically, as regards disarticulation, when the anterior part of the foot is depressed, the articular surfaces sepa-

rate so that the line becomes almost transverse from side to side. The operation is performed as follows :—The surgeon ascertains the position of the scaphoid bone, by feeling its projection towards the plantar surface of the foot, and if operating on the right foot places his forefinger upon that point, whilst his thumb rests about three-fourths of an inch behind the projection of the fifth metatarsal bone. He makes a gently curved incision, the convexity towards the toes, across the dorsum of the foot, about an inch and a half in front of the joint, and separates the skin-flap with a few touches of his knife, whilst the assistant retracts it. He next forms the plantar flap, by cutting from without inwards, and then opens the joint from its external aspect, and completes the operation by disarticulating; or he may, after forming the dorsal flap, disarticulate by depressing the foot forcibly, and cutting up on the joint, and then pass the blade of his knife beneath the bones, and cut out the plantar flap, as represented in Hey's amputation in Plate xxxix. Fig. 7; but, as I have already said, I prefer shaping and cutting the plantar flap from without, before disarticulating.

Chopart's operation is one which I never perform now. I used to perform it before amputation at the ankle was introduced; but, though much preferable to amputation through the leg, it never left a very useful stump, and I consider it far inferior to amputation at the ankle. The gastrocnemius and soleus muscles having nothing to counteract them, draw up the heel; and hence the patient does not rest on the heel but on the fore part of the stump. Again, if the amputation be performed for disease of the tarsus, we leave the two bones which should of all others be removed, as being likely to partake of diseased action, and subsequently require another operation for their removal. If you ever do this operation, I would advise you to divide the tendo Achillis at the same time. You would thus equalise the balance between the muscles on the front and back, until adhesion of the divided tendons of the leg had taken place, and so you might prevent retraction of the heel.

AMPUTATION AT THE ANKLE-JOINT is, both in regard to safety and the formation of a useful stump, perhaps the most successful of all amputations. It may be performed either by Mr. Syme's method, or by a large internal flap ; and when the stump is fairly healed, it is very difficult to tell which method has been used—the result is so similar. Mr. Syme's method, as described by himself, is as follows:—"When the operation is to be performed, pressure should be made on the tibial arteries by the fingers of an assistant, or a tourniquet applied above the ankle. The only instruments required are a knife, of which the blade should not exceed four inches in length, and a saw. The foot being held at a right angle to the leg, the point of the knife is introduced immediately below the maleolar projection of the fibula, rather nearer its posterior than anterior edge, and then carried across the bone (sole ?), slightly inclining backwards, to the inner side of the ankle, where it terminates at the point *exactly opposite* its commencement. The extremities of the incision thus formed are then joined by another passing in front of the joint. The operator next proceeds to detach the flap from the bone, and for this purpose, having placed the fingers of his left hand over the prominence of the *os calcis*, and inserted the point of his thumb between the edges of the plantar incision, guides the knife between the bone and nail of the thumb, taking great care to cut parallel with the bone, and to avoid scoring or laceration of the integuments. He then opens the joint in front, carries his knife outwards and downwards on each side of the astragalus, so as to divide the lateral ligaments, and thus completes the disarticulation. Lastly, the knife is carried round the extremities of the tibia and fibula, so as to afford room for applying the saw, by means of which the articular projections are removed, together with the thin connecting slice of bone covered by cartilage. The vessels being then tied, and the edges of the wound stitched together, a piece of wet lint is applied lightly over the stump, without any bandage, so as to avoid the risk of undue pressure in the event of the cavity becoming distended with blood, which would be apt to occasion sloughing of the flap. When recovery

is completed, the stump has a bulbous form, from the thick cushion of dense textures that covers the heel, and readily admits of being fitted with a boot."—(See Plate xxxix. Figs. 1, 2, 9, 10, and 11.)

AMPUTATION BY LARGE INTERNAL FLAP (Plate xxxix. Figs. 12 and 13) is performed as follows :—Suppose the right foot is to be removed, it is held firmly, resting on its outside. The surgeon inserts his knife over the tendo Achillis, and cuts obliquely across that tendon towards the outer and plantar aspect of the heel, then curves his incision inwards across the sole of the foot, and then upwards in front of the internal malleolus, till it crosses the tendon of the tibialis anticus, so as to form the large internal plantar flap. Next, without removing his knife from the incision, he continues to cut across the dorsal aspect of the foot, about an inch below the ankle, until the incision terminates at the point where he commenced the operation. The flaps are then rapidly dissected up, taking care to avoid injuring the posterior tibial artery. Finally, disarticulation is accomplished, a section of the tibia and fibula removed as in Syme's method, and the vessels secured. When the patient rests on his side, the flap lies in position almost by its own weight, and any serous or other discharge escapes very readily, so that the stump generally heals more quickly and solidly than when the other plan is adopted, in which discharges are apt to accumulate in the heel-flap. To obviate this, Mr. Syme used at one time to make a counter opening, to allow free escape. That, however, is unnecessary, for if, after Syme's operation, the patient be made to rest on his side instead of being laid on his back, the discharges will escape at the fibular angle of the incision, which should be left a little open.

Various modifications of amputation at the ankle have been proposed, such as leaving the upper portion of the astragalus, in connection with the malleoli, instead of disarticulating it. Pirigoff's amputation consists in making the incisions somewhat in the same way as in Syme's method, except that the line of the plantar flap is well in front of the malleoli. After dissecting

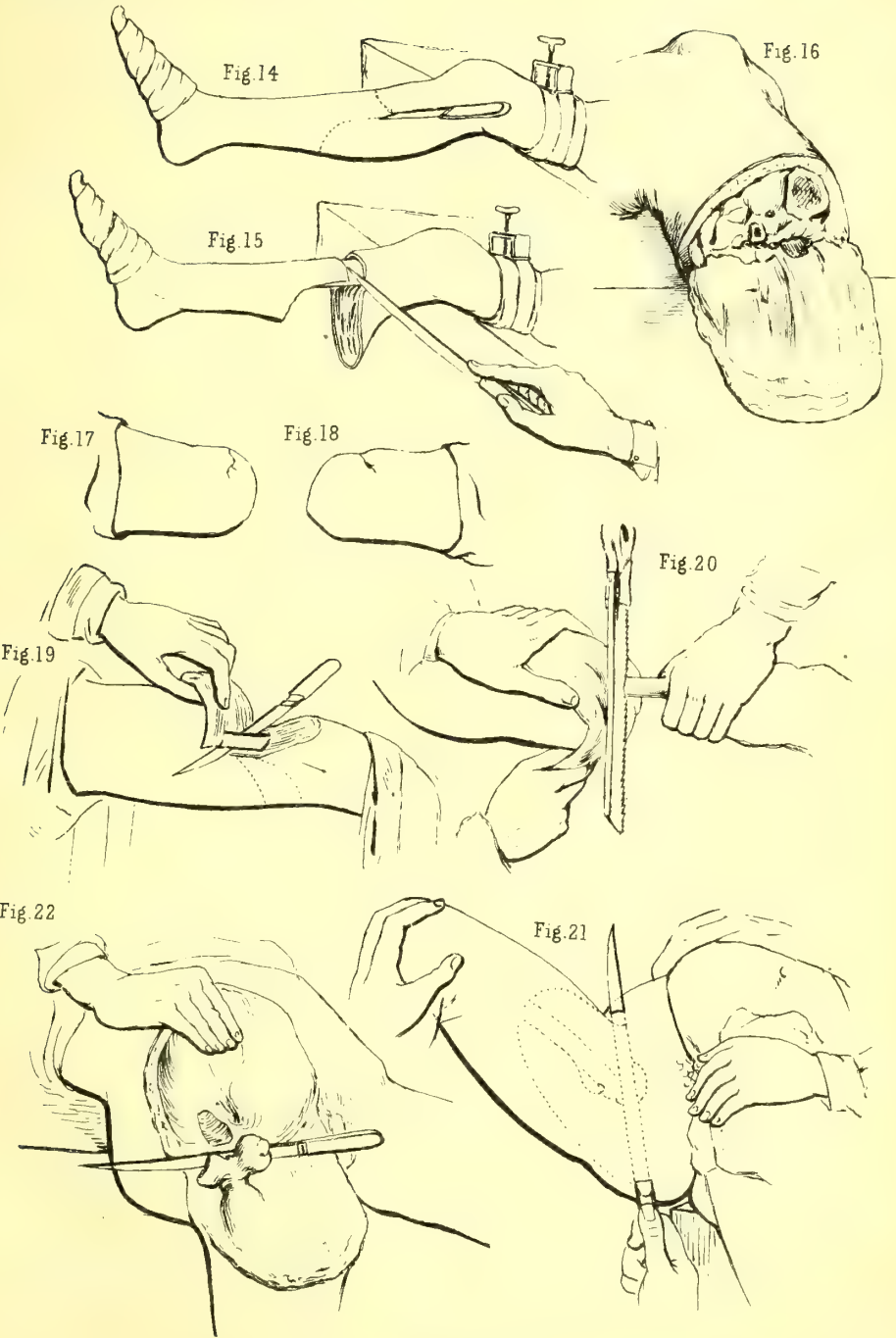
this flap beyond the line of the joint, but not from the heel, he disarticulates, and next saws through that part of the os calcis behind the joint, then saws off the ends of the tibia and fibula, as in the other methods, and applies the section of the calcaneum, retained in the plantar flap, to the section of the tibia and fibula, so that the osseous surfaces may unite. From what I have seen of such modifications, I consider them as anything but improvements on either of the methods I have described ; because they retain portions of bone, which, in cases of caries, have a predisposition to become, if they be not already, affected by the disease, and because the stump left is by no means so well fitted to support the weight of the body, nor so well adapted for progression.

LECTURE XC.

Amputation of the Leg : Primary and Secondary ; by the Circular Method ; by long Posterior Flap ; by Teale's Method—Amputation at the Knee-Joint—Amputation at the Thigh by transfixion : by long Anterior Flap ; Author's Method ; by Circular Method—Amputation at the Hip-Joint : Advantages Steps of the Operation—Artificial Limbs.

AMPUTATION OF THE LEG may be performed either by the modified circular method, or by the long posterior flap, or by Teale's method of a long anterior skin flap. When the operation is performed for chronic disease, the muscles of the calf are generally atrophied and somewhat condensed ; and, in such cases, the long posterior flap method is, I consider, preferable to any other, as affording a well-covered stump on which the weight of the body may rest ; and the patient is thus enabled to walk with ease. This plan of operating, and its results, are shown in Plate xl. If the right leg is to be amputated, the operator stands on the inner side of the limb, places the heel of his knife over the outer margin of the fibula, carries the blade across the front of the leg until the point reaches a little behind the inner edge of the tibia. He then, without moving the point from the incision, transfixes the limb, and cuts out a long gently-rounded flap from the calf of the leg. The skin and flap are retracted, the bones cleared and sawn through a little higher than the point of transfixion. The point of election for section of the bones should be very little above the middle of the leg. In young patients or females, where there is a considerable amount of fat, a flap of skin may be obtained, by cutting from without inwards, and the limb removed near its lower third ; but the cases requiring amputation of the leg seldom admit of the operation being performed lower than the middle of the leg.

In sawing the bones, it is sometimes recommended to remove



the anterior angle formed by the section of the tibia, by first sawing the tibia obliquely before sawing it through ; but I have found this to expose the bone too high beyond the section, and now, when I find the angle very acute, I remove it, after section, either with the bone-pliers or a small saw. A good deal has been written about the difficulty of transfixion in this operation, and the risk of passing the knife between instead of behind the bones ; but, with ordinary care, and keeping in mind the oblique position of the fibula in relation to the tibia, there should be little risk of such an occurrence. I have never felt any difficulty, nor have I ever seen it happen, even with students practising the operation on the subject.

In cases of primary amputation of the leg, or when the muscles of the calf are largely developed, the transfixion method is objectionable, owing to the redundancy of muscle left not only preventing the parts being brought and kept in position, but as leading to tension and suppuration, and increased risk to the patient. This result is depicted in Plate xxxiii., from a sketch taken by the late Sir Charles Bell to show the disadvantage of the flap method. In such cases I have occasionally made my assistant retract the skin, and then removed the redundant muscle with a single stroke of the knife. Still, in primary amputations, I prefer the modified circular method, or rather a short anterior and longer posterior flap of skin cut from without inwards, a very small amount of muscle only being retained near the bones. The soft parts are then retracted fully, and the bones sawn higher up. In this amputation, when performed high up in the leg, difficulty is sometimes encountered in securing the posterior tibial artery. It retracts amongst the deep muscles, and cannot be readily seen or secured. In such circumstances, the best plan is to divide the interosseous membrane, and dissect so as to expose and tie the vessel. In the after-treatment of the stump, the patient should be made to lie on his side, which tends to obviate the pressure of the tibia on the anterior skin flap, and also allows the posterior flap to lie better in position to the bones.

The method of a long anterior skin flap proposed by Mr. Teale I do not consider to be well suited to the leg. I have tried it in one or two cases, but its result is not equal to the long posterior flap, and there is a greater risk of the tibia causing ulceration; and the long thin flap is liable to suffer from want of vascular supply.

AMPUTATION AT THE KNEE-JOINT, when we have an opportunity of performing it, in proper cases, should always be done in preference to amputating higher up. The difficulty is, that from the great bulk of the articular surface of the femur, we can seldom, in cases of injury, obtain a sufficiency of soft parts for a covering. The operation is performed by cutting a long and broad anterior flap of skin, beginning below the tuberosity of the tibia, and dissecting it up, removing the patella. Next, we divide the integuments on the posterior part of the limb, a little higher up, and when the skin is retracted for about two inches, the remaining soft parts in the popliteal space are divided obliquely towards the posterior surface of the joint. Then the knee is forcibly bent, the ligamentum patellæ, lateral, crucial, and posterior ligaments, divided, and disarticulation of the leg completed, the vessels secured, and the flaps adjusted and retained by sutures.

When considering the general subject of amputation, I took **AMPUTATION OF THE THIGH** as the example of the different methods of operating; and hence, as these have been already fully described, as regards the principles on which they are performed, I need do no more than very briefly describe the manual procedure adopted in the principal methods.

Amputation by double flaps, formed by transfixion.—The flaps should always be anterior and posterior, and are formed thus:—The operator stands on the inner side of the right and the outer side of the left limb, so as to command the bone whilst sawing it. An assistant, standing on the opposite side, places the palm of his hand against the posterior part of the thigh, at the part to

be operated on, so as to press upwards the soft parts, and relax those on the anterior aspect of the limb, to enable the operator to grasp and raise them from the bone, and thus to transfix with greater ease and obtain a broader flap. The limb below the knee is to be in this, as in all amputations, firmly supported by an assistant, seated in front of the patient. The surgeon transfixes the thigh, about an inch and a half below the point he intends to saw through the bone, and cuts out a broad and rounded flap, re-inserts the knife an inch lower than the first point of transfixion, and cuts the second flap from the posterior part of the thigh. Both flaps are retracted, and the assistant supporting the limb raises it a little, to cause the bone to be projected fully. Then the point of the knife is used to clear the bone higher up, and the saw applied to the highest point where the bone is exposed, and close to its attachments to the soft parts. So soon as the bone is sawn through, the assistant must avoid further retraction of the flaps, lest the periosteum be dragged upwards, and leave the bone denuded. The arteries are then tied: the femoral, at any point below the middle of the thigh, will be found on the surface of the posterior flap, towards its inner side, the vein lying behind it; the terminal branch of the profunda will be found close to the posterior surface of the bone and rather to its outer side. The muscular and cutaneous branches, often very numerous, must be tied where they are seen to jet or ooze. The flaps are then cleansed, placed and retained in apposition by sutures, and supported by compresses of lint, and a roller, to support the flaps; the line of incision over the end of the stump, being left uncovered. As regards the relative length of the flaps—in Mr. Liston's method the anterior flap is the shorter, and the posterior is cut long, to allow for its greater retraction to equalise the length of the flaps after the operation is completed. The line of his incision for the posterior flap is shown by the lower dotted line in Figure 19, Plate xl. The modification of Liston's plan which I used to practise before adopting the long anterior flap, and which I still practise in some cases, is to cut the anterior flap longer than the posterior. The

upper curved dotted line, in the plate already referred to, represents my line for the posterior flap. The anterior flap is thus drawn more over the end of the femur after cicatrisation of the stump.

I have already fully described my method by the long anterior flap, and given my reasons for adopting it. The manual procedure is as follows :—The limb being held as in the other methods, the surgeon standing on the inner side of the right, or on the outside of the left limb, measures with his eye the breadth of half the circumference of the thigh, inserts his knife into the side of the limb, immediately above the outer or inner condyle, according as he is operating on the right or left thigh, carries the incision down to below the lower margin of the patella, sweeps the knife across the front of the knee with a gentle curve, and terminates the incision on the opposite side of the limb, on a level with the point where he entered his knife at first. The large flap, so marked out, is dissected rapidly upwards from off the patella and front of the joint. On clearing the upper margin of the patella, the surgeon cuts deeply and obliquely upwards, so as to retain muscular structure, and as much thickness of substance as possible in the upper part of the flap. He then applies the edge of his knife to the textures on the posterior aspect of the limb, about two inches below the base of the anterior flap, and divides them obliquely to the bone. The soft parts are then retracted, and the femur sawn through just above the condyles ; the vessels secured and flap retained by stitches ; but there is no need to apply any bandage or dressing ; all that is required is to pin a handkerchief across the thigh, to prevent jerking of the stump.

CIRCULAR AMPUTATION OF THE THIGH is so exactly similar to the same operation in the upper arm, that it need not be further described here. The modification of the circular method proposed by Mr. Syme, will be found fully described in Lecture lxxxiii. page 745.

AMPUTATION AT THE HIP-JOINT is undoubtedly one of the most formidable operations of surgery, and demands for its proper performance decision and rapidity in operating. The idea seems lately to have entered some minds, that the shock will be diminished if amputation through the trochanters be first performed, and then the head of the bone dissected out and disarticulated. I can hardly conceive anything more likely to increase shock than a prolonged operation, or rather double operation ; and the difficulty of dissecting out the head and neck of the femur, after section through the trochanters, is very great. In one of my own cases, I was unwillingly obliged to disarticulate after this fashion, the shaft being separated at the trochanters by diseased action ; and I found it by no means an easy matter, as it is difficult by any artificial means to compensate for the loss of the leverage of the thigh-bone. Certainly, rapidity of execution does not seem to increase shock, for of my three successful cases—In one, disarticulation was performed in ten seconds ; in another, in fifteen seconds ; and in the primary amputation, which was more complicated, it was effected in less than thirty seconds. I think the proposal I have alluded to must have arisen from confounding two things which are essentially different. It is quite true that in cases where amputation has been previously performed at the upper part of the leg or through the thigh, and in which, at some subsequent period, return of the disease has necessitated amputation at the hip-joint, the risk and shock are very much diminished, and the reasons for this are obvious ; but that is a very different thing from performing first one and then a second operation at the same time, with a view to diminish shock.

I have no hesitation in saying, that from my own experience, rapidity of execution in this operation is of great importance, as diminishing the risk from shock and loss of blood ; and in cases of tumours, where we have the leverage of the whole limb, the disarticulation may be accomplished in from ten to thirty seconds. The chief things to be attended to for its rapid (not hurried) performance are,—attention to the position of the patient ; that

the hip projects well over the table, whilst the pelvis is kept firmly secured, so as to prevent the body receding : this allows the limb to be fully depressed after the anterior flap is formed, and also facilitates the other movements necessary for enabling the knife to be passed readily beyond the trochanter major, so as to cut the posterior flap. The direction given to the knife in passing it across the front of the limb to form the anterior flap is all-important as to the ease with which the subsequent steps will be accomplished.

Operation.—In operating on the right limb, the surgeon, standing on the inside of the limb, which must be abducted, and slightly flexed on the pelvis, should enter the knife immediately in front of the tuber ischii, and carry it steadily in an oblique direction across the front of the joint to a point nearly midway between the great trochanter and crest of the ilium, and cut a rounded flap of sufficient length from the anterior surface of the limb. In doing this, great care must be taken to make the knife pass close in front of the head of the femur, and to turn its edge obliquely towards the joint ; so that, when the flap is formed and raised, the capsule will be found to be opened, and when the limb is forcibly depressed, the head of the femur either at once starts out, or a single cut upon it divides the remaining portion of the capsular and round ligaments. Then nothing remains to be done but to clear the trochanter major, and form a posterior flap, somewhat shorter than the anterior.

The hæmorrhage is controlled during the operation, either by applying an abdominal tourniquet, or by compressing the femoral on the brim of the pelvis, as in amputation of the thigh. The femoral artery should always be commanded, even when an abdominal tourniquet is employed, as it may slip or require to be removed from interfering with respiration. When the anterior flap is cut, the assistant grasps it so as to command the vessels completely ; and on disarticulation being accomplished, another assistant compresses the surface of the posterior flap with a large sponge, raising it from time to time to allow the bleeding points to be secured. Then the femoral vessels are tied, the nerves cut short,

and the flaps approximated. Two flat compresses of lint, supported by a broad spica bandage, are applied to maintain the surfaces in apposition, and prevent blood accumulating in the stump. The greater part of the line of union is left uncovered, and one suture left untied to allow any blood to escape, so that attention may be at once directed to any excess of oozing which may take place on reaction.

The space already occupied by the subject of amputation forbids me entering on that of ARTIFICIAL LIMBS, which I felt very much tempted to do had my limits permitted. The form and usefulness of many well-formed stumps are marred by badly-fitted artificial substitutes—wonderful pieces of mechanism sometimes, but not serviceable for the purposes for which they are wanted. I allude especially to those intended as substitutes after removal of the thigh. The mechanists in general seem slow in taking the trouble to understand the difference of adaptation required in an artificial limb for a stump, the end of which is intended to support directly a considerable part of the weight of the body, and one in which the position of the cicatrix unfits it for bearing pressure, and so all are arranged on the old system for the latter class, and the advantages of a long thigh-stump, obtained by the anterior flap method, are in a great measure lost. The simplest and best artificial limb adapted for a special purpose is one described by Mr. Pollock, as suited for stumps formed by amputation at the knee-joint, and constructed by Mr. Blaise. I have only seen photographs of it, for which I am indebted to the politeness of Mr. Pollock ; but judging from these, it seems at once simple and perfect for the purpose, and I should think very little difficulty would be found in adapting it to suit the long thigh-stump formed by the method of amputation I have recommended, or that formed by the methods of Teale and Carden. In regard to artificial limbs for the upper extremity, they may be made ornamental, and, to some extent, even useful ; but no one will be Utopian enough to expect that any mechanical adaptation will form a substitute for the hand.

CLINICAL CASES

ILLUSTRATING THE SUBJECT OF AMPUTATION.

SUCCESSFUL CASE OF PRIMARY AMPUTATION AT THE HIP-JOINT.

ON the 3d of September 1863, Robert Davidson, a young lad, was thrown from a truck which had been suddenly set in motion, and fell in front of it, both wheels passing obliquely over the upper part of the left thigh just below the pelvis. The accident happened at the Melrose station, and the boy was seen almost immediately by Dr. Clarkson, who adjusted the limb, and had him conveyed to his home at Newstead, about a mile distant. About two hours afterwards, Drs. Brown and Smith accompanied Dr. Clarkson to see the case. The boy had recovered in a great measure from the shock, but his pulse was still very weak. On examination, there was found a large contused flesh wound at the upper and inner part of the left thigh, exposing the muscles, which were much torn and bruised, and allowing the finger to be passed deeply into the tissues of the limb. The femur at and below the trochanters was felt to be much shattered. The foot was cold, and pulsation in the popliteal and tibial arteries extremely weak, but there had been no great amount of blood lost.

As it appeared to the medical attendants that the boy's only chance of life was removal of the limb by amputation at the hip-joint, I was telegraphed for, and arrived at the patient's house about 9 P.M. On examination of the injury, the contused and lacerated state of the soft parts, the shattered condition of the femur, and the consideration of the great force by which the injury had been caused, left no doubt as to the practice to be pursued. I at once coincided in the opinion which his medical attendants had expressed, although, from the depressed state of the young patient, and the proximity of the injury to the trunk, the chances of success seemed very small.

The boy's parents having given their consent, I proceeded to perform the operation under circumstances not the most favourable. The room was small, and the only light procurable was from a small lamp on the mantelpiece, and two small candles held by a non-professional assistant; a wax taper I had brought with me was kept in reserve for exigencies. I had brought the abdominal compressor, but as it could not be applied so as to command thoroughly the circulation, Dr. Smith took charge of compressing the common femoral on the brim of the pelvis, and I instructed one of the patient's friends how to command the bleeding from the posterior flap, by grasping it with one hand and pressing a large sponge upon its surface. Dr. Brown took charge of the movements of the limb, whilst Dr. Clarkson administered the chloroform. When the boy was brought under its influence, I entered my knife between the trochanter major and the anterior superior spine of the ilium, and carrying it obliquely across the thigh, brought the point out a little above the tuberosity of the ischium, cutting a short anterior flap. Dr. Brown then rotated and depressed the limb, with the view of facilitating disarticulation; but owing to the shattered state of the femur, this movement did

not produce the desired effect. Fortunately, however, this caused no great delay, for my knife had opened the joint in passing across the limb ; and by grasping the upper broken fragment of the bone, so as to project the head, I completed the disarticulation, and cut as large a posterior flap as I could obtain from the uninjured parts. Some vessels on the posterior flap were first secured, and then the great vessels in the anterior flap,—the vein being included in a ligature. I then removed some contused and doubtful-looking portions of muscle. After all bleeding had been arrested, the flaps were brought together with sutures ; and considering the nature of the parts from which the flaps were formed, they fitted tolerably well. The stump was then dressed, and the patient placed in bed, hot bottles applied, and some stimulus given, as he was very weak. He lost very little blood during the operation, as I ascertained by carefully collecting the blood from the stone floor, when it was found to amount to less than half a small teacupful ; and altogether, with what was in the sponges, to about five ounces at most. After waiting till the little patient had completely rallied from the chloroform, and had got an opiate administered, I left him in the charge of Dr. Smith, who remained with him all night, and to whom I am indebted for the following report of the progress of the case :—

Examination of Limb after Removal.—On examination of the limb after removal, the femur, from the large trochanter downwards for about two inches, was found to be broken into numerous fragments, the ragged edges of which were embedded in the surrounding soft parts. The muscles and other structures were much bruised and torn, but there was no direct injury to the large vessels or nerves.

Progress of Case.—*4th September.* During the night patient was very restless and delirious. Pulse 134, weak. A little brandy and water was administered at intervals, but was vomited. No reactionary hæmorrhage of any consequence. *Vespere.*—Still restless, with delirium. Pulse 130. To have opiate with a few drops tinc. mur. ferr.

5th. Restless night. Pulse 130, very weak and thready. Sunken aspect of countenance. Beef-tea, brandy, and milk given in small quantities frequently.

6th. Rather better. Slept a little. Less delirium. Pulse 108, stronger. Wound has healthy appearance, except at the bruised part of the flap, which looks sloughy.

7th. Pulse 108. Sloughing action extending slightly on posterior flap. Fætid sero-purulent discharge. Chloride of soda lotion. Opiate.

8th. Pulse 90. No delirium. Line of demarcation formed, showing slough, rather exceeding a square inch in extent. Purulent discharge copious and less fætid.

9th. All the stitches removed, and the flaps brought together as well as possible by strips of plaster. Pulse 100.

12th. Sloughs separated. An attack of diarrhœa. Slight delirium. Opiate.

14th. Pulse 108. Diarrhœa less. Stump looking healthy. Diet for the most part milk, beef-tea, wine, with a little brandy.

16th. Doing well.

20th. Pulse has risen to 120. Had a restless night with delirium

Raw surface of stump covered with patches of whitish semi-translucent membrane of pretty tough consistence. Copious purulent discharge. Stimulants given in increased quantity.*

21st. Pulse 120. Occasional delirium. Wound has same appearance

23d. Pulse 118. Wound has less of its diphtheritic-looking covering.

27th. Stump looks healthy, and is cicatrising round the edges. Dressed with sulphate of zinc lotion. Pulse still high, 116. Sleeps well. Appetite indifferent.

1st October. Pulse 110. Doing well.

4th. Pulse 102.

From this time recovery was slow but uninterrupted. The patient gained strength gradually, with the aid of tonics, wine, etc. The femoral ligature did not fall off till 4th November, two months after the operation, having evidently been retained for some time after its separation from the vessel by the granulations surrounding it. By the middle of December the stump was healed, with the exception of a mere spot. Two or three weeks later this also had closed, and the patient was able to move about with the aid of crutches.

Remarks.—I have thought this case would be interesting because successful results in cases of amputation at the hip-joint are rare, and in primary amputations exceedingly so. In the last edition of Cooper's *Surgical Dictionary*, it is stated that there have been six cases of primary amputation at the hip performed in Great Britain since 1838, and all of them proved fatal. In the Crimea fourteen amputations at the hip-joint were performed by British surgeons for injury, and not one recovered; and in the Punjab in 1848-49, three cases occurred, with the same unfavourable result. And, so far as I am aware, the case I have just detailed is the first successful primary amputation at the hip-joint in Scotland. But the principal interest which such a case possesses, seems to me to be the consideration of those circumstances or conditions which may have conduced to the successful result, and which may influence our practice in similar cases.

The age of the patient may seem to explain the favourable result. It has been said that in young patients, from the greater remedial powers of nature, and the smaller surface exposed by the operation in them, the operation is likely to be more successful; but this is very questionable. The remedial

* Dr. Brown informs me that diphtheria was prevailing in the district at the time.



powers in young persons are no doubt great, when once a certain point has been passed ; but the first effects of shock, either from accident or operation, and especially the loss of blood, are not well borne by such patients, and these, together with the irritability of constitution, which is often marked, in a great measure, I think, counterbalance the remedial powers observed in them. Then, as to the less amount of cut surface, though less absolutely, it is quite as great comparatively to the size and vital powers of the patient. The amount of mutilation, the consequent derangement of the circulation, and all the risks depending on these conditions, are at least as great relatively in the lad as in the adult. From what I have observed in the case of primary amputations in young children, the patients sometimes sink rapidly and without any apparent cause, whilst even the successful cases are often attended at first with as urgent constitutional disturbance as in adults. Indeed, the state of the patient whose case I have recorded, shows how great was the constitutional shock during the first four days, and how slowly full reaction set in. The true causes of success will, I think, be found in the nature of the injury, the small amount of blood lost, and the comparatively little shock he was subjected to after the occurrence of the accident.

1st, As to the character of the injury. Although so excessively severe as to necessitate amputation, and though in dangerous proximity to the trunk, the destructive force was limited to the parts over which the wheels had passed,—there was no laceration of the limb below, nor of the abdominal region above, and there was little bleeding from the contused wound. Then the boy was seen immediately, the limb adjusted, and he was conveyed at once to his own home, so that he scarcely suffered any secondary shock from removal. Now, let me contrast these conditions with those of another case occurring in my hospital practice, and some of the causes which greatly determine the results will be pretty apparent. A man was admitted under my care in consequence of an injury inflicted by the explosion of a large iron flask containing gunpowder. The flask, the metal of

which was about a quarter of an inch thick, had been in close contact with his body when it exploded, and the wound was therefore similar to that caused by the bursting of a shell. The thigh was almost separated from the trunk at the upper and inner part. The pectinæus, adductors, and the hamstring muscles, at their origins from the tuber ischii, were divided and torn into shreds, whilst the front of the abdomen and lower part of the thorax were severely scorched by the explosion. The femoral artery, largely exposed, had escaped injury, but the vein seemed twisted and injured, as the blood was coagulated in it. There had been considerable bleeding from the arterial branches divided, and slow oozing into the textures of the limb was going on when the patient was brought into the hospital. The accident had occurred in Lanarkshire, and the patient had to be conveyed partly by road, and then by railway to Edinburgh. In this case also, the only chance of life and relief from suffering was removal of the limb at the hip ; but after rallying during the first twenty-four hours, he died on the third day. Here, in contrast to the case of the boy, we see the disadvantages of a long and tedious journey, and renewal of shock from time to time, from the unavoidable movements in being so conveyed to town ; the slow loss of blood from oozing into the tissues of the limb ; the extent and severity of the wound, and the scorching of the abdomen and chest, an injury very dangerous in itself ;—such circumstances are sufficient, I think, to explain the fatal result,—and from what I have observed in cases of primary amputations, these are conditions which, according as they are present in greater or less degree, most materially influence the success of such operations.

Perhaps it may seem that I do not sufficiently appreciate the importance of the patient enjoying the benefits of pure country air, instead of that of a hospital ward. But whilst it is perfectly true that there is much need of doing all we can to improve the ventilation of our hospitals, the dwellings of the working-classes in the country are not always or even generally models of ventilation. In the case of the boy, the room he oc-

cupied was a small closet, low in the ceiling, just large enough to contain a small fixed bedstead, leaving barely room to pass between the bed and the wall,—its only means of ventilation a small window and the door opening into the common room of the family, which also contained beds, so that whatever the purity of air in the country round, he did not enjoy much of it. Without denying the bad effects of vitiated air in hospital wards, and the necessity of doing all we can to remove that cause of mischief, I cannot help saying that a good deal of nonsense is spoken and written about the dangers of operations in hospitals as compared with those in private practice, as if all depended on hospital air alone. From some of the discussions on the subject by correspondents in the weekly medical journals, and from recent proposed methods of ascertaining the results of surgical operations in hospitals, it would almost seem as if some statisticians had so crammed their brains with mere figures as to have no room left for a single idea, or even so small a glimmering of common sense as to make allowance for the nature and class of cases admitted into great hospitals, or to pay the least attention to the circumstances under which the patients are when admitted.

As to the operation itself, the difficulties were only such as must always more or less present themselves in operating in cases of injury, where the lacerated textures prevent us from obtaining regular flaps, and where the comminution of the bone deprives the operator of the power of leverage to facilitate disarticulation. There was, however, comparatively little difficulty here, although the fragment I had to grasp was small, because I had taken care to pass the knife deeply so as to open the front of the joint in cutting the anterior flap, and by doing so the difficulty of disarticulating was much diminished. There was however, a condition present which I have seen cause serious difficulty in amputation of the thigh for compound comminuted fractures when transfixion was attempted, I mean the dragging up of the lower part of the femur, by the hamstring and adductor muscles, and the projection of the trochanteric or upper part

by the psoas and iliacus flexing it on the pelvis, so as to project it towards the skin, and prevent the knife being carried down in cutting outwards. In this case it was of no consequence, because the soft parts in front were so injured that I could not get a long anterior flap ; but, supposing the tissues to have been sufficiently sound, the bone was so tilted forward that I could not have carried the knife onwards. In such cases I would strongly recommend cutting the flap of integument and fascia from without, and then transfixing across the joint, or to cut the flap altogether from without inwards as is now generally done in primary amputations of the limbs. In regard to the vessels, it will be observed that in this, as in a former successful case of hip-joint amputation for disease, I put a ligature on the femoral vein as well as on the artery. In my former case I did so with great dread of the result, but I have since done it in some cases of amputation, and as they all did well, I am sometimes inclined to think that, instead of being hurtful, as I used to dread, it may possibly be useful as preventing imbibition or absorption of purulent or sanious matter from a large wounded surface ; but I confess I have still so much of lingering prejudice that I do not like to try or urge the practice generally. I have, however, no hesitation now in applying a ligature when venous bleeding is troublesome after amputation.

AMPUTATION AT THE HIP-JOINT.

L. S. was admitted into the Royal Infirmary on the 13th of July 1862, on account of a large tumour occupying the middle and lower parts of the right thigh. The previous history of the case is contained in the subjoined extract of a letter from Dr. Meikle :—" I attended Miss L. S. and two of her sisters, in September 1861, during a mild attack of fever. She rapidly recovered, and did not again come under my observation till April last, when I was requested to examine her right thigh. The lower third of the femur was considerably enlarged, and the soft parts surrounding it were firm, and closely matted together. The circumference of the affected portion of bone seemed bulged out in all directions, and enlarged veins were seen ramifying on the surface of the tumour. The condyles of the femur were not involved in the disease, and the portion of the shaft above the tumour was of normal size. I was told that Miss S. had felt more or less uneasiness in the part since the date of the febrile

attack ; but she could trace it to no cause, having sustained no accident. The pain at this time was very moderate, being more, indeed, a sense of uneasiness than anything else, but it was increased during the night. Measurements were taken from time to time, which showed that the tumour at first was increasing in size, but not quickly, until July last, when, after exposure to cold in an open conveyance, she was seized with pleuritis, which reduced her strength very much. From this date the tumour made rapid progress, and it became evident that nothing but amputation would save the girl, for which purpose she was put under your charge. When I first saw her, her face had a somewhat dingy appearance, and it gradually became darker, until it assumed a leaden hue."

Symptoms on Admission. Patient is pale, emaciated, and presents a very cachectic appearance ; pulse rapid and irritable ; chest and urine found normal on examination ; no glandular enlargement ; tongue slightly furred. The whole circumference of the middle and lower part of the right thigh is occupied by a large tumour, over which the veins are greatly distended. The surface of the tumour is irregular, and there is at points an indistinct feeling of fluctuation. There is no œdema of the leg, nor glandular enlargement in the groin.

15th July. To-day Mr. Spence performed amputation at the hip-joint in the following manner :—The patient having been put under chloroform, Lister's tourniquet was applied to the abdominal aorta. The breech was brought well over the edge of the table, and the pelvis held steady by an assistant. The tourniquet was intrusted to Dr. Gillespie, while Dr. Watson compressed the femoral artery at the brim of the pelvis. Mr. Spence having abducted, and slightly flexed the limb on the pelvis, gave it in charge to Dr. Struthers. Then grasping the soft parts with his left hand, Mr. Spence entered the point of the knife in front of the tuberosity of the ischium, and passing it obliquely upwards, in front of the articulation, brought out the blade almost midway between the anterior superior spine of the ilium and trochanter major, so as to form a large anterior flap, disarticulated the limb, and terminated by cutting a posterior flap nearly equal in size to the anterior. A large sponge was immediately applied to the posterior flap, until the large vessels in the anterior flap were secured. No artery jetted so long as the tourniquet was retained. After the arteries had been tied, and the tourniquet removed, the femoral vein continuing to bleed, a ligature was placed upon it. The flaps were then stitched together, and a pad placed on the anterior and posterior surfaces to keep them in apposition. The patient having been removed to bed, a beef-tea and brandy enema was immediately administered, and after she had rallied an opiate was given.

16th July. Slept well ; pulse 130 ; no reactionary hæmorrhage since the operation.

17th. Pulse 128 ; patient progressing favourably.

18th. Pulse 120.

19th. Pulse 116 ; some of the stitches removed, and straps of plaster applied ; has been taking beef-tea, wine, milk, and a little brandy for diet.

20th. Pulse 106 ; stump looking well ; no dressing on the wound except a narrow strip of lint along the line of incision, and a pillow to support the hip.

21st. Pulse 116 ; wound dressed with chloride-of-soda lotion.

22d. Pulse 110 ; some more stitches removed to-day.

23d. Pulse 106 ; the remaining stitches were removed, and straps applied.

24th. Pulse 98 ; patient is taking tincture of the muriate of iron, nourishing diet, and wine.

25th. Pulse 102.

26th. Pulse 100 ; two ligatures came away to-day.

28th. Stump looking well ; appetite good ; general appearance of patient very much improved.

29th. Pulse 100 ; tongue cleaning.

30th. Pulse 100.

31st. Pulse 96.

1st August. Pulse 90.

2d. Pulse 86.

3d. Pulse 90.

12th. Pulse 86 ; femoral ligature came away to-day ; stump almost entirely healed up.

13th September. Since last report, recovery has gone on in a most favourable manner. Not an occurrence worthy of notice has interrupted the convalescence, and to-day she returned to the country in a state of health bordering on that of former years. During the last fortnight she has been walking about the ward, and has been out several times for a drive.

Remarks.—The mortality which attends amputation at the hip-joint, and which has even led some to question the justifiableness of the operation, is undoubtedly very great ; and hence considerable interest attaches to every successful case, the circumstances under which it was performed, and all the conditions which may have a bearing upon the general question of the operation in similar cases. According to the latest statistics of the operation, given in the recent edition of Cooper's *Surgical Dictionary*, we find that, in a total of 139 cases, there were 91 fatal results, or a mortality of 65·46. Moreover, when we know that in several of the successful cases the operation was performed on limbs which had previously undergone partial amputation, and where consequently the shock and disturbance of the system caused by the sudden removal of the whole lower extremity were wanting, or at least greatly diminished, it seems evident that the risks of this formidable operation are such as must limit its performance to cases of extreme necessity.

In cases of certain severe injuries the surgeon may be forced

to perform it as the only chance of saving, or, at least, prolonging life, and alleviating suffering, by removing the shattered limb. In cases of disease, the question of operation comes before us under a somewhat different aspect, for the amputation may prove more speedily fatal than the disease would have done if left to its own course. Hence, to warrant its performance, the disease must be of a kind that admits no other remedy, and at a stage when the whole of the appreciable disease can be removed, and with a reasonable hope of prolonging life. In the case which forms the subject of the present remarks, we have a good example of the conditions which warrant us in having recourse to amputation at the hip-joint. The girl was suffering from intense pain, her appetite was almost gone, and her strength exhausted by the pain and want of sleep; her pulse was quick and irritable, whilst the tumour was increasing rapidly. The urgency of these symptoms showed the necessity of operative interference, if any attempt was to be made to relieve her sufferings and to prolong life, even for a short time; whilst the absence of glandular enlargement, either in the groin or elsewhere, gave hopes that the lymphatic system was as yet unaffected, and that, with youth on her side, there was a reasonable hope of success attending the operation. On the other hand, if it were delayed, or not performed, a speedy and painful death was certain.

The disease was limited as far as malignant disease can be said to be limited in the living body, where the circulation of the fluids prevents positive limitation to any special part. But, practically, surgeons are agreed, from experience, that malignant disease, especially its medullary form, when situated in an anatomically limited organ—as the testicle, for example, where it is invested by a dense resisting capsule—admits of more thorough removal than when it occurs amongst muscles or other soft textures, whose structure it speedily involves in the same diseased action, without any definition or limitation. In the present case the disease had evidently commenced in the interior of, and was still apparently confined to, the shaft of the femur. Thus walled in, as it were, by the dense fibrous shell of the bone, or by the

strong fibrous periosteum investing the shaft on every side, and closed in at either extremity of the bone by the articular cartilage of incrustation, the disease presented the utmost possible degree of anatomical limitation, and thus the best possible chance of complete removal. But to profit fully by this limitation of the disease, it was evidently necessary to amputate in the contiguity, and not through the continuity of the affected bone—a rule which I consider of paramount importance in such cases. Hence the reason why I considered amputation through the trochanters inadmissible, although the bone seemed unaffected; for, in many cases where no perceptible alteration in the form of the bone can be detected, the disease will be found to be infiltrated into the cancellated texture, even of the neck and head of the bone; and there need be the less hesitation on this point, as I believe that, in cases of malignant tumours of the femur, amputation through the trochanters is attended with quite as much danger to life as amputation at the hip-joint.

I would here refer to the necessity which arose for applying a ligature to the femoral vein. The hæmorrhage from this vein continued after all pressure had been removed from the groin and abdomen, and as temporary pressure of its orifice, and other means, failed to arrest it, and as it returned whenever the pressure was removed, I found it absolutely necessary to tie it. I have frequently seen troublesome bleeding from the femoral vein in amputation of the thigh, but in general it stops when compression is made by applying the flap against the cut surface, when all pressure above is removed, and the stump elevated; but here these means proved ineffectual, or, perhaps, I should rather say the weak condition of the patient rendered it necessary at once to check all loss of blood. I confess that my prejudices against tying veins are very strong, and this step in the operation made me uneasy as to its effects; but, as the history of the progress of the case shows, my fears were groundless, not a single bad symptom having followed ligature of the vein.

In conclusion, the uninterrupted progress of the patient's recovery was most satisfactory. It is not often that even a

simple amputation of the thigh goes on so well; and whatever may be the estimate of the operation in general, or whatever may be the chances of the disease returning in some other organ hereafter, it has, for the present at least, snatched the patient from the brink of the grave and restored her to her family, and to the enjoyment of perfect health.

AMPUTATION AT THE HIP-JOINT.

M. W., aged 5 years, was admitted on May 29, 1865, into the Royal Infirmary, suffering from a tumour of the right thigh.

History.—Patient's mother states, that about six months previous to admission the child complained occasionally of wandering pains in the right thigh, for which fomentations were applied. About three months previous to admission, however, the mother observed the patient walking as if her right knee was stiff; she had a considerable amount of pain in the limb; was sometimes fretful and low-spirited, but her general health was good. On being asked where she had pain, the patient referred it to various parts of the thigh; and on examining locally, the mother observed an oval lump on the outside of the lower part of the thigh, about the size of a "blackbird's egg," and said to be deeply seated. No increase of growth was observed, however, till about ten weeks before admission, when the child is said to have received a blow on the lower part of the thigh (with a chair), and since that time the tumour has been increasing rapidly. Since then, the patient has also complained greatly of pains in the limb, on account of which the part has been fomented, poulticed, and leeches, without any relief. The parents then consulted Dr. Thomson of Yetholm, who, recognising the nature of the case, prevailed upon them to send her to the Infirmary. During the last few days, the patient has been losing her appetite, is low-spirited, and complains more of pains.

On admission into hospital.—Patient appears to be healthy, but is unusually quiet and reserved. Tongue slightly furred; lungs, heart, and other organs, normal. A tumour, of oval form, $5\frac{1}{2}$ inches in length, and about the same in breadth, was found occupying the anterior, outer, and posterior surfaces of the middle and lower part of the femur, just above the condyles. It is of firm consistence throughout, and moves along with the femur. The superficial veins are enlarged, but the skin is not adherent. Patient does not complain of pain on pressing the tumour. The inguinal glands on both sides, as also the right cervical glands, are hard, and somewhat enlarged.

1st June.—P. 86. Sleeps well, and is much better in health. Ordered alterative medicine, followed by tincture of the muriate of iron and cod-liver oil, twice daily.

6th.—P. 96. Has had more darting pains in the limb. General health continues good. Tumour not perceptibly larger since admission of patient into hospital.

7th.—P. 80. Slept well. Chloroform having been administered,

Professor Spence made an exploratory incision into the swelling, and discovered it to be a tumour, as diagnosed. The patient's pelvis was then brought well over the edge of the table, and held firmly by an assistant. Professor Spence next, grasping the soft parts with his left hand, entered the point of the knife at the front of the ischial tuberosity, and passing it obliquely upwards in front of the articulation, brought it out almost midway between the anterior superior iliac spine and the trochanter major, so as to form a large anterior flap. Having opened the joint by this first incision, while Dr. Gillespie abducted the limb, the disarticulation was effected, and a posterior flap nearly equal in size to the anterior one was cut from within outwards. Immediately thereafter, a sponge was applied over the posterior flap; Dr. Watson compressed the vessels over the brim of the pelvis. The vessels, including the femoral vein, were then ligatured, the flaps stitched together, pads placed over the anterior and posterior surfaces, and bandaged. When the effects of the chloroform had passed off, an opiate was given, but the patient continued very restless, requiring to be held down for some time. No reactionary hæmorrhage took place.

On examining the limb, the tumour was found to be of a greyish colour, of firm consistence, and of a medullary character. Microscopic examination of the adductor muscles of the thigh showed the nuclei of the muscular fibres to be greatly increased in number, and seemingly about to undergo cancerous degeneration. The fibres of the gluteus muscle showed fatty degeneration, but no proliferous cells.

6.30 P.M.—P. 80. Patient has been sleeping continuously for some hours, is very thirsty and restless at intervals, and vomits on trying to take food.

9 P.M.—P. 100. Urine drawn off with a catheter. Opiate given as vomiting continued.

8th.—P. 100. Spent a very good night. Urine drawn off with a catheter.

4.30 P.M.—Patient has been sinking gradually, and is now unconscious. Pulse, not perceptible; respiration, rapid and very weak; has slight bronchitis; eyelids partially closed, and eyes oscillating. Ordered Spt. ammon. arom. in five drop doses, every five minutes; also an enema of beef-tea and wine, and a mustard-poultice to the chest.

6.30 P.M.—Still continues in a very weak state. P. 156, and very weak; respirations, 60 per minute; has had her bowels opened freely. Beef-tea injections given every hour, and sal-volatile at intervals.

11 P.M.—Under this treatment patient rallied gradually; but as the nervous symptoms continued, fifteen drops of sol. mur. morph. were added to the beef-tea injections. P. 140; respirations, 40 per minute and regular; has grinding of the teeth, twitchings of the face, with knitting of the brows, and gives occasional starting and delirious exclamations.

1.30 P.M.—P. 150, weak. Cerebral symptoms and general weakness somewhat increased.

9th, 10 A.M.—Has slept well during the night, and cerebral symptoms are absent. P. 140, weak; takes no food, and is supported by enemata; respiration regular and not laboured.

4 P.M.—Continues in much the same condition; has occasional grinding of the teeth and startings of the limbs. P. 112. Supported by enemata.

10 P.M.—P. 130, and weak. Same treatment continued.

12.30.—P. 140, and weak. Consciousness returned and patient is inclined to sleep; cough somewhat increased, and pain in the abdomen complained of. Ordered a large poultice over the chest and abdomen; takes some food.

10th, 4 A.M.—P. 120. Has been sleeping calmly, but is beginning to start somewhat, and grinds her teeth slightly.

8 A.M.—P. 104. Very weak; is unconscious; grinds her teeth; lies with her eyes wide open, and complains of great tenderness in abdomen. Enemata continued, and poultices on abdomen.

10 A.M.—P. 116. Drinks milk heartily; stump dressed and looking healthy.

12 M.—P. 120. Weak; some of the old symptoms returned. Enema given. From this time forward, patient gradually recovered. None of the cerebral symptoms returned, and appetite gradually improved.

11th.—P. 100. Is in good spirits; slight erythema along the edge of the wound. Some stitches removed. Discharge somewhat increased.

12th.—P. 108.—Patient continues to do well. This morning she took a hearty breakfast of porridge and milk, in addition to tea, toast, and eggs. The stump looks very well; there is not much discharge, and it is of a healthy character. As the cough is troublesome she is ordered to-day the following mixture:—℞ Ammon. sesquicarb. grs. xxiv.; tinc. scillae, ʒii.; decocti Senegae, ad ʒvi.; sig. a teaspoonful every three hours.

13th.—P. 104, of good strength. During the night she slept well, but was observed to start occasionally. Plasters applied to stump and stitches removed. Dressed with soda lotion.

15th.—P. 90; bowels regular; appetite good.

17th.—All the the ligatures except one have separated. General health continues to improve. At the inner angle of the stump is a hard, red, and painful swelling, evidently an abscess commencing to form; for this fomentations were applied. P. 110.

21st.—P. varied from 104 to 120 during the night. Stump looking very well. Sleeps soundly. Appetite good.

23d.—P. 104. Yesterday, passed four, and to-day eighteen ascarides lumbricoides, of which some were very large. Ordered a purgative, followed by ℞ Santonin, gr. viii.; sacchar. ʒi.; M., et divide in pulv. iv.; Sig. one to be taken night and morning.

25th.—Passed two more worms of the same kind, but smaller. Appetite has fallen off somewhat. The abscess in the groin burst to-day at the outer angle of the stump.

July 3d.—Since last report convalescence has been uninterrupted. To-day passed another small worm, which was the last.

From this date onward the patient improved daily. Appetite returned by degrees. The femoral ligature was withdrawn on July 6th, and the incision healed up without the slightest bad sign, and remains quite sound at the present date.

Whilst it is generally admitted that the true principle in regard to amputation for malignant tumours of bone is to amputate be-

yond the bone affected, yet in the case of the femur, the dread of the immediate risks of amputation at the hip-joint has led practically to the abandonment of the principle, and amputation through or near the trochanters, in cases of malignant tumour, is often advised, and resorted to, as being safer than disarticulation, unless the growth is so high up as nearly to involve the trochanter. I think this a very serious error, as I believe, in such tumours, the disease permeates the whole of the medullary and cancellated texture of the femur, and that there is no security for the removal of the disease except in removal of the entire bone, by disarticulation ; and from what I have seen of high amputations in the thigh, for malignant tumours, I believe the risks of amputation through or near the trochanters to be as great, if not greater, than those of amputation at the joint. In the latter, the rapidity of performance is greater, the loss of blood less ; whilst the risks of pyæmia are certainly less in cases of disarticulation than in amputation through the continuity of a bone, where we have the chances of myelitis, inflammation of the veins of the medullary Haversian canals, and acute necrosis, which are especially liable to occur in the state of the system accompanying malignant disease.

Besides the interest which attaches to a successful case of amputation at the hip-joint, that just recorded possesses interest in regard to the diagnosis of the disease, and the condition and treatment of the patient after the operation.

The general history of the disease from its commencement ; the obscure wandering pains referred to the thigh long before any alteration in the limb was detected, and then the appearance of a small but distinct lateral swelling as described by her mother, together with the subsequent rapid growth and increased pain, were all very characteristic of malignant disease of the femur. On the other hand, however, there was not the slightest appearance of the peculiar cachectic state which so generally accompanies malignant growths ; the child was of ruddy complexion and plump, her appetite good, and all the functions natural, though she was restless and somewhat irritable at night. The

mother, however, had with her another younger child, evidently affected with strumous swelling of the periosteum, bones, and glands. At the time of the patient's admission into hospital there was no lateral projecting swelling, simply an elongated ovoid swelling, or enlargement of the femur, from the condyles to near the trochanters. Under these circumstances the question arose,—Might not these symptoms be caused by periostitis and subacute osteitis, and perhaps incipient necrosis? To my own mind, the absence of rigors or febrile symptoms at any time during the progress of the disease, the distinct lateral swelling noticed at first, and the peculiar ovoid form of the enlarged femur, seemed pretty conclusive as to its being a malignant tumour of the bone; but still, under the circumstances, before proceeding to such an extreme measure as amputation at the hip-joint, I considered it right to resort to an exploratory incision, as recorded in the report. In many instances a free exploratory incision will at once satisfy the surgeon as to the true state of matters; but here it had a tendency to mislead, for, owing to the cancerous deposit being situated partly within the medullary canal of the femur, and partly between the periosteum and the shaft of the bone, and easily separable, it resulted that when I introduced my finger into the incision, I felt the bone bare and loosely connected with swollen periosteum, just as in a case of necrosis, so that I had to enlarge the incision considerably to judge of the true state of the swelling. I draw attention to this, because unless I had been pretty well decided before as to the nature of the disease, the condition presented in this case, so different from the irregular softened mass mixed with osseous spiculæ, generally met with in malignant osseous tumours, might have led to a wrong diagnosis and most disastrous results.

The method of operating in this case was the same as that I adopted in the case of L. S., previously recorded, and I think it the best in such cases where we have the power of choosing our procedure. Amputation at the hip can be readily performed by cutting one very large anterior flap, and disarticulating and dividing the posterior parts almost directly backwards; but as

examination shows that even at an early period the muscles near the diseased bone are liable to be affected, it is of vital importance to plan our operations to avoid proximity to the tumour, so as to diminish the risk of retaining any morbid tissue in the flaps. Hence I prefer two shorter flaps to one very long one, as it must encroach more on the diseased parts by its greater length. In this, as in other successful cases I have recorded, the femoral vein was tied to arrest bleeding, and I believe, as I have stated elsewhere, that instead of being hurtful it seems rather to do good, by preventing pus or unhealthy discharge entering the venous circulation by the large open mouth of the vein, kept patent as it is by its fascial connections.

The progress of the case as given in the report shows how much success in such operations depends on careful after-treatment, watchfulness of symptoms, and persistence in appropriate remedial measures, even when the condition of the patient seems very hopeless.

It will be noticed that the urgent unfavourable symptoms in this case did not supervene till about twenty-four hours after the operation, when the risk from primary shock and reactionary hæmorrhage had passed. The morning report on the 8th June was "Pulse 100 ; spent a very good night," and at my visit at noon the child presented no unfavourable symptom ; but shortly after 3 P.M. symptoms of restlessness, nausea, and a state approaching to collapse, as detailed in the report, set in suddenly, and at 4 P.M. she seemed to be rapidly sinking. I believe that, but for her being very carefully watched, and the prompt and continued use of external and internal stimuli, the little patient must have soon died.

The character of the symptoms was peculiar : there had not been the slightest amount of reactionary oozing from the stump, and the child had slept well after the operation. Yet the state must have been the effect of the operation on the nervous system ; although it is just possible that the tenderness of the abdomen, the grinding of the teeth, and convulsive startings, may have been due to the presence of so many large intestinal worms ;



for though the more severe symptoms passed off, and she gradually began to amend, yet her rapid and thorough convalescence dated from the time the worms disappeared under the use of the *santonine*.

PRIMARY AND SECONDARY AMPUTATIONS FOR INJURY.

I have selected the following as examples of the class of cases requiring amputation in consequence of injury, and as illustrative of what I have said in reference to the conditions which influence the mortality of primary amputation :—

SEVERE INJURY OF THE RIGHT UPPER EXTREMITY BY MACHINERY; AMPUTATION OF THE SHOULDER-JOINT; RECOVERY.

CASE I.—On the morning of the 9th December 1847, James Watt, mill-wright at a large paper-mill in the vicinity of Edinburgh, when inspecting the machinery, perceived that a part of it was loose. While engaged in fastening the loose part, the sleeve of his jacket was caught, and the right arm dragged between two wheels, and rapidly crushed. Notwithstanding the fearful nature of the accident, he possessed sufficient presence of mind, on feeling himself drawn forwards, to take off his cap with his left hand, and place it in a position to check in some measure the revolution of the wheels, and at the same time he directed those about him to cut the sleeve of his coat, telling them that the arm was already torn through. He was extricated just in time to prevent the body being drawn in, but not before the soft parts on the right side of the chest had suffered severely. The accident happened about half-past four A.M., and I saw him at half-past seven A.M.

I found Mr. Falconer and Dr. Thomson in attendance. The patient was lying in bed, pale and exhausted, having lost a considerable quantity of blood; but, though suffering great agony, he was quite sensible; the fragments of his clothes which had been left by the machinery had been removed, some stimuli had been administered, and external warmth applied; his pulse was about 120, and the skin was covered with cold sweat. The injured arm presented a frightful appearance; the limb was completely detached from about three inches above the elbow, and the humerus was again broken through obliquely immediately below the insertion of the deltoid, leaving the attachment of that muscle entire; but on the inner side, the fracture had splintered the bone up to within an inch of the joint; the middle part of the humerus, together with the soft parts, were hanging in shreds. On the right side of the chest, the integuments had been entirely removed to within two inches of the sternum; the clavicular and sternal portions of the *pectoralis major* had been completely torn off, so as to expose the *pectoralis minor*, the intercostal

spaces, and externally the fascia covering the axillary vessels and nerves. The fragment of the humerus was drawn upwards and outwards by the deltoid, and the lower fibres of the great pectoral which were entire, were tightly stretched across the lower border of the large wound, and gave it the appearance of a deep dissection. Although, from the nature of the injury, and the state of the patient, I had almost no hopes of his recovery, I thought it right to give him the only chance—viz. by amputation at the shoulder-joint.

A small quantity of spirits and water having been given, chloroform was then administered. About a drachm was poured upon some lint and applied to his nostrils by Dr. Thomson. He inhaled it readily, and scarcely a minute had elapsed ere it took effect: the fibres of the exposed muscles were first seen in violent action, and the face became suffused, the breathing became stertorous, the fibres of the muscles assumed a slight tremulous motion, and then became perfectly still; his pulse fell in frequency, but was firm; the full effect of the chloroform was obtained in three minutes.

Mr. Falconer compressing the axillary artery between his fingers, above the lesser pectoral, I proceeded to amputate by forming my flap from the outer and back part of the shoulder, where the integument and muscles appeared sound, saving as much skin as possible. From the short lever remaining, I had anticipated considerable difficulty in disarticulating the head of the humerus; but in this I was agreeably disappointed, for, owing to the complete relaxation of the muscles induced by the chloroform, I was enabled to disarticulate it rapidly and with the most perfect ease. The insertion of the lower fibres of the great pectoral, and the other soft parts on the inner side of the humerus were divided, and the fragment of the limb removed. The posterior circumflex and two other vessels were tied, and next the axillary at the point where my incision had divided it: perceiving, however, that this point was close to the origin of some large branches, and fearing, moreover, lest it might have suffered from the injury, I laid bare the vessel higher up, beneath the lower margin of the pectoralis minor, and tied it there also; after removing carefully all doubtful-looking portions of muscle and skin, the flap was brought forward and found to cover the wound much better than I expected; it was secured by several points of suture, supported by compresses placed posteriorly at the lower part to prevent dragging, some warm-water dressing was placed over the surface anteriorly, and the whole secured by a split cloth bandage.

During the whole of the proceedings, which occupied about a quarter of an hour, the patient remained perfectly tranquil, and only became conscious after the dressing had been completed; a little wine and water were then given. He stated that he had felt no pain, and indeed knew nothing of the operation, but now felt much easier and revived; his pulse was at this time 68, and pretty firm. I left him in charge of Mr. Falconer, desiring that he should have an opiate draught. According to Mr. Falconer's report, the pulse gradually rose, and at three P.M. was 84 in the minute. There was considerable thirst, and he complained of darting pain in the wound, also of slight nausea, which, however, soon left him. In the evening he was less thirsty; the pulse continued the same, and he

passed about six ounces of urine. Had a draught of thirty drops of solution of morphia at midnight.

At four A.M. on the 10th his pulse was slightly accelerated and harder; he had slumbered occasionally for about half-an-hour at a time, but woke with pain in the wound; the skin was warm and moist, and after he had passed about six ounces of high-coloured urine, he fell asleep, and rested for some time; at noon he had a laxative draught.

On the morning of the 11th he continued pretty easy, having passed a good night, but as his medicine had not acted, he got a dose of castor-oil. His tongue was white and furred. Before twelve o'clock his bowels had acted twice freely, and his skin was moist, and of a natural heat; he was allowed a little beef-tea. In the afternoon his pulse had risen to 100 in the minute, and was pretty full, though soft. The beef-tea was discontinued, and a little thin arrow-root allowed instead. In the evening he had passed water freely, and felt easy, but his pulse was still about 100, and the skin hot; had no headache. To have a draught of morphia and ipecacuan wine at bed-time.

12th.—7 A.M. Has passed a good night, pulse diminished in frequency and soft, skin of a moderate heat.—3 P.M. Has suffered from sickness since morning. The wound was now dressed for the first time, and at his own request chloroform was administered; but after it began to affect him, vomiting took place, and Mr. Falconer desisted from its use. The wound was found of a favourable appearance; suppuration had commenced at the lower part; a little wine was administered previous to the dressing; he felt much easier after its completion, when an opiate draught was given.

At 10 P.M. his pulse was 92, and soft; he still felt sick, and had not slept since the dressing. To have a large opiate draught.

13th, *Monday*.—Passed a bad night; suffered greatly from sickness and vomiting; pulse 96, tongue covered with white fur, but red at tip and edges; half a grain of solid opium was given him. At noon the bilious vomiting and sickness still continued; pulse 100, countenance anxious. To have one grain of solid opium. At six P.M. he was much easier, the vomiting had ceased; he had taken a little thin arrow-root and drank some tea. As he had no evacuation from the bowels since Saturday, an enema was ordered, and after it had acted a grain of opium was given at 10 P.M.

On the 14th I saw him along with Mr. Falconer, and dressed the wound, which I found uniting at the upper part, and granulating at the other parts of the wound, the suppuration was of a healthy character; he bore the dressing without much fatigue; his pulse previous to the dressing was 86 and soft, the expression of his face and general appearance good. He had had no return of the nausea or vomiting, but his tongue was still somewhat furred, and he complained of thirst. For the purpose of allaying thirst and abating the irritability of the stomach, I sent him some citrated alkali for effervescing draughts.

On the 17th, one of the ligatures came away, and on the 18th another, but without the slightest tendency to bleeding; from this time he continued to go on favourably; the wound healed rapidly, and no circumstance worthy of note took place, except a slight attack of bronchitis, which was promptly and actively treated, and he was able to leave his bed

on the 1st of January 1848 for a short time, at which period a great part of the wound had cicatrised. On the 8th of January the ligature from the upper part of the axillary artery separated (this ligature had been marked at the time of the operation by a double knot on its free extremity; the ligature from the lower part of the vessel, where it had been divided in the amputation, came away on the 17th of December).

In the beginning of February the wound was completely healed, with the exception of one part about the circumference of a sixpence, where a ligature projected, this I took away some time afterwards, and then this remaining part also healed up rapidly.

Remarks.—This case affords an example of the great amount of injury from which the system may recover; and the results of this and similar cases warrant us in entertaining hope and having recourse to operative measures even in the most aggravated cases. Few examples of injury could have presented a more frightful appearance, or less likelihood of a favourable result, not so much from the shattered state of the arm and the quantity of blood he had lost, as on account of the extent of the laceration of the soft parts covering the chest, one side being almost denuded of its cutaneous and muscular coverings, and the patient lying cold, pallid, and collapsed, from the effects of the severe suffering he had undergone.

From the state in which I found him, I have little doubt that, had he been removed even a short distance to obtain surgical aid, the result would probably have been very different. Indeed, from what I have seen of primary amputations, I believe that the very different results of such amputations in civil hospitals and military practice, and the comparatively greater success which will be found in private practice over hospital cases, is owing in a great measure to the fact, that in military and private civil practice, the operation is performed either on the spot, or at a short distance only from where the accident occurred, so that the patient undergoes but one shock; whereas a majority of the cases presented to the surgeon in hospital practice, are often brought from a considerable distance, not in the easiest or most eligible conveyances,—and thus the patient, just recovering from the first effects of severe injury, is subjected to a second shock, or rather series of shocks, from the jolting of the

shattered limb, before undergoing amputation; a condition which, in itself, apart from other considerations as regards the effects of hospital air, etc., is evidently less favourable than that of the patient to whom surgical assistance has been afforded without his having undergone a rough and exhausting journey.

There is another point to which I would direct attention, as I consider it of some importance to the prevention of secondary hæmorrhage, in cases where there is extensive injury of the soft parts around the vessels. In severe accidents from direct violence by machinery, the parts even beyond the apparent injury often suffer indirectly, their vitality is impaired above the points of amputation, and extensive suppuration or separation of small sloughs takes place around the vessels, or the vitality of the arterial tissue itself may have been so impaired by the traction and twisting, that separation of the ligature will probably take place, and secondary hæmorrhage occur, at a period before the canal of the artery has been obliterated. It was to avoid such a risk in this case, that besides tying the axillary at the point, divided by the knife in amputating, I laid it bare and tied it higher up; and the result, I think, shows the propriety of the practice, for the lower ligature came away in eight days, so that, except for the ligature higher up, secondary bleeding would likely have occurred at that time. The case has also this interest, that it was the first great operation in which I used chloroform, which had just been proposed, instead of ether.

INJURY BY MACHINERY—DEATH FROM SECONDARY HÆMORRHAGE.

CASE II.—In October 1852 I was sent for by Dr. Ellison of Penicuik, to see a young man who had received a severe injury of the right arm by machinery in a paper mill. I found the soft parts of the arm from near the shoulder, and down the forearm, extensively lacerated, the muscles in the upper arm being fairly stripped off the humerus, a portion of the inner side, comprising the great vessels, having alone escaped. The bones were not fractured, but from the nature and extent of the injury, and the complete destruction of the muscles and skin, it was evident that amputation at the shoulder-joint was the only chance for the patient.

This I did by lateral flaps, disarticulating and then forming the inner flap by cutting outwards. Whilst I was cutting outwards through the

nerves and vessels, the patient, having partially recovered from the chloroform, made a sudden movement, which threw off the hold of the gentleman who was compressing the subclavian artery, and a gush of blood from the axillary blinded me ; but luckily I succeeded in grasping the vessels and nerves, and secured the whole mass temporarily, till I had tied the smaller vessels ; then I cleared the axillary higher up, and placed a ligature upon it, removed the temporary ligature, closed the flaps by suture, and dressed the stump.

Next day I found the patient going on favourably : there had been slight venous oozing, which was arrested by cold water cloths, and there was now neither oozing nor tension of the stump. On the fifth day the patient was going on exceedingly well ; a large part of the stump had healed by the first intention, though at the lower part, there was a considerable discharge of pus along the course of the ligatures, and a little erysipelatous redness.

Late at night, on the sixth day after the operation, I was sent for, on account of the sudden occurrence of hæmorrhage, but before I reached his house, the patient was dead.

On opening, and examining the stump, the greater part was found solidly adherent, and even along the course of the vessels, there appeared to be no great amount of sloughing or suppuration. The hæmorrhage was from the axillary, which presented an open mouth, as if cut with a knife, to the extent of about two-thirds of its circumference, the ligature being still attached to the remainder. I learned from Dr. Ellison that the patient had been exceedingly well all that day, and that Dr. E. had seen him shortly before the bleeding occurred. It came on either during, or shortly after, the patient had been turned in bed, and though Dr. E. succeeded in arresting it by pressure, so much blood had been previously lost, that he soon sank.

CASE III.—J. C. was admitted in a state of great prostration, due to a severely compound comminuted fracture of the humerus, with the limb almost severed from the trunk ; a dislocation of the right hip ; and a very severe wound of the dorsum of the foot. As the chief laceration of the tissues was on the inner surface of the arm, amputation was performed by a long antero-posterior flap cut from without. Died twelve hours after admission.

CASE IV.—John L., æt. 66. Compound comminuted fracture of the arm and forearm, the result of a railway injury. The patient had come from a distance, and had lost a large quantity of blood. Amputation by a long external, and a short internal flap cut from without. He sank next day.

Remarks.—Primary amputation at the shoulder-joint is one of the most successful of the major operations. If a fatal result speedily follows its performance, as in the two last cases, it will be found to depend on unavoidable causes, such as the complex nature of the injuries, hæmorrhage, etc. One died from the

severe shock arising from the crushed arm, the dislocated hip, and the lacerated foot; the other, an old man, perished from the effects of the loss of a large quantity of blood previous to admission.

Secondary hæmorrhage, which occurred in the amputation at the shoulder (No. II.), is by no means a common cause of death after primary amputations; but as it has led to a fatal result in other cases of amputation at the shoulder-joint, it may be as well to examine into its probable causes in the case narrated.

The artery had been tied well up from the margin of the flap, where all the tissues were apparently sound; there seemed to have been no want of healthy action in the stump, as the greater part had united, and there did not seem to have been any great amount of suppuration even along the course of the vessel; yet the bleeding occurred at a very early period, and the vessel, little altered in appearance, seemed as if cut with a sharp instrument for about three-fourths of its circumference; in short, divided by acute ulceration, presenting no appearance of internal clot or external plastic effusion.

The nature of the injury, in this case, may probably account for the result, for the arterial tissue may have suffered from the dragging and twisting by the machinery, and thus had its vitality impaired to a much greater extent than would at first sight appear. When the injury necessitating amputation is direct, as a crush by machinery or the wheel of a carriage, the arterial tissue is not likely to be affected much beyond the parts injured; but when the limb has been dragged and twisted by machinery, as in this case, then, as I have said, the effect of the traction may have injured it much higher, and hence the more rapid ulceration caused by the ligature. I suspect, also, from what I was told, that the patient, feeling pretty well, had not been so quiet as was desirable, and he was being moved when the hæmorrhage occurred.

DOUBLE PRIMARY AMPUTATION OF ARM.

T. A., æt. 25. Both hands and lower part of forearms blown off by the explosion of gun-cotton in a quarry. Though patient was very weak and only partially conscious, Professor Spence amputated both arms as being patient's only chance. Patient lived for one hour after the operation.

SECONDARY AMPUTATION OF ARM.

G. G., æt. 17. While leading a horse by the bridle the animal seized the forearm with his teeth, and inflicted a compound comminuted fracture. He was under treatment for ten days previous to being sent to hospital. Conservative measures were tried, and a fortnight after admission several pieces of bone were removed. Under the prolonged discharge from the wound, and from the ulcers which had formed over the sharp prominences of the condyles, his general health became impaired. The inflammatory action extended towards the wrist, and in the fourth week suppuration occurred within the joint. Under such circumstances, there could be no hesitation in removing the limb. The operation was performed below the middle of the arm by a long external and short internal flap formed by transfixion. Recovered.

PRIMARY AMPUTATIONS OF THE THIGH AND LEG.

1. John Reilly. Compound fracture of tibia and fibula, communicating with knee-joint, the result of a railway carriage passing over his leg. Amputated at lower third of femur. Long anterior flap. Pyæmia set in, and patient died at the end of the fourth week.

2. Alexander R——, whilst in a state of intoxication, fell under the wheels of a railway carriage, and sustained a compound comminuted fracture of both legs—in the one communicating with the knee-joint, whilst the other limb was almost completely cut off below the knee. Amputation of both limbs performed at lower third of femur. Patient never rallied, and died on the third day.

3. Jessie Brown was violently whirled round by machinery, and sustained a very severe compound fracture of thigh, together with laceration of perinæum. The limb was amputated very high up; but patient never rallied, and died on the following day.

4. R. B. Compound comminuted fracture of right leg and arm. A railway carriage had passed over the leg, crushing it to a complete pulp. This patient having lost a large quantity of blood previously, was admitted in a state of complete collapse, from which stimulants freely administered failed to rouse him. As there was oozing of blood into the tissues of the leg, amputation by the long anterior flap was performed at the lower third of the thigh, as affording the only chance of life. Had the state of the patient admitted, the arm also would have required amputation. He lived twenty-six hours after the operation.

5. P. L—— fell down a height of thirty-five feet, and was brought to hospital suffering from compound comminuted fracture of femur, commu-

nicating with knee-joint, and a similar fracture of both bones of leg. Amputation at middle of thigh. Cured.

6. J. M'C., æt. 33. Compound comminuted fracture of the leg communicating with the ankle-joint, resulting from a railway-truck having passed over the limb. Amputation below the knee by long internal, lateral, and short external flaps, cut from without inwards. There was not the slightest tendency to the projection of the margin of the tibia ; the recovery was rapid and complete.

7. C. C., æt. 73, was knocked down and run over by a loaded van. The chief injury sustained was a compound fracture of the leg, for which amputation below the knee was performed by the long posterior flap cut from without. She had been a habitual drunkard for years, and was intoxicated at the time she sustained the injury. The wound remained in a very inactive state, the discharge being thin and serous. She died on the sixteenth day after admission.

8. J. M., æt. 25. Compound comminuted fracture of leg and ankle, resulting from a railway waggon passing over the limb. Amputation by a long posterior flap. Recovered.

Commentary.—As regards the advantage of primary over secondary amputation in all cases where there is no reasonable hope of saving a useful limb, or where the risks to life seem too great to warrant any attempt to save the limb, I think there is now very little difference of opinion amongst practical surgeons ; but in these days of conservative surgery, some few looking at the admitted danger of primary amputations, such as those of the thigh, seem to think that in almost all cases we should make the attempt, or at least delay, for, say they, you may perhaps save the limb, and if not, you can always amputate later with perhaps a better chance of success. But this is assuming what is not the fact, for every surgeon who has had much experience in accidents, knows, that in cases of compound fracture, where legitimate attempts have been made to save the limb, the most general cause of a fatal result is pyæmia, not exhausting discharge, or even gangrene, which are comparatively rare ; and, consequently, if we delayed in more hopeless cases, we should probably never have the opportunity for the secondary operation to which they would have us trust.

I would merely refer to the fatal cases of amputation of the thigh, as showing the nature of the accidents requiring this operation as their only chance for life, and as exemplifying what

I have said as to the causes which influence the mortality of the greater primary amputations.

First, we have the case of a poor girl, caught by machinery ; her thigh crushed, the perinæum lacerated, and then brought into the hospital from a very considerable distance, the amputation requiring to be performed through the trochanters.

Next, we have the case of the man R——, who had one leg torn off, and the other crushed and mutilated by a railway truck, who had lost much blood and lain exposed, no one could exactly say how long, but at least an hour and a half, in one of the coldest nights of last winter, and both of whose thighs required to be amputated immediately. The third fatal case, that of John Reilly, was one where the amount of injury was less than in either of the former, it being a compound fracture extending into the knee-joint, caused by a railway waggon passing over the leg ; this man was brought from a distance, and had lost some blood, though not, I believe, a large amount, before reaching the hospital. Although much depressed at first, he went on very favourably till the end of the third week, when symptoms of pyæmia set in rather suddenly and destroyed him. But here, as in all cases of railway accident, I suspect the general shock is much greater than it appears, and tells ultimately on the constitution. I have noticed that even the less severe compound fractures so caused not unfrequently terminate fatally by pyæmia, after seeming to progress favourably for two or three weeks. A circumstance connected with this very case seems to show how severe the shock may be without any very extensive local injury. It happened that the young man who succeeded Reilly in his post at the railway met with a similar accident about eight days afterwards, and was also sent to be under my care. On admission he was pale and collapsed ; he had stimulants administered, and when I saw him, six hours after the accident, he had revived ; and as I found he had suffered a compound fracture into the knee-joint, I had him removed into the operating-room for the purpose of amputating the limb ; but as he was about to be lifted from the basket, I observed his face very pale, and on feel-

ing the pulse it had become so weak, that I desired him to be left, and stimulants and heat to the surface to be applied. I waited with him for above an hour, but he still continued in the same collapsed state. I then ordered the treatment to be kept up, and left him, and on returning, two hours afterwards, I found he had just expired without ever rallying. I and all who saw him concluded he must have received some injury of the pelvis, or rupture of some internal organ, or had internal hæmorrhage; but the most careful post-mortem examination of the body revealed nothing beyond the local injury and the shock to account for death. From this and other instances I would infer, as I have already said, that in cases of injury by great direct force, as by railway, or machinery, and gunshot, such a shock may be caused as may affect the powers of life immediately, as in this case, or more slowly and gradually leading to the form of pyæmia which proved fatal in Reilly.

The fourth case, that of R. B., is an example of a class which I have referred to in my lectures, where the surgeon is obliged to amputate at once, notwithstanding the depressed state of the patient, in consequence of bleeding going on amongst the textures of the limb.

In the successful case we have an example of a much greater amount of injury to the bones of the limb, as there was a greatly comminuted fracture of the femur, communicating with the knee-joint, and fracture of the bones of the leg, but caused by indirect violence from a fall; and though much more advanced in life, and not of strong constitution the patient suffered comparatively little constitutional disturbance after the operation, whilst, had it been delayed, I have no doubt the result would have been very different. The fatal case of amputation of the leg is scarcely a fair example of primary amputation, as nearly thirty hours had elapsed since the injury before the operation was performed, the patient having been sent from a very long distance to town, conditions very different from what we have in cases of amputation performed soon after the injury. At the time this case was under my care, I operated in private on a female patient above sixty

years of age, on account of compound fracture into the ankle-joint ; she made an excellent recovery, but then the operation was done soon after the accident, and without removal of the patient.

PRIMARY AMPUTATION OF THIGH; DEATH FROM MORTIFICATION OF STUMP.—(*Cases referred to in Lecture lxxxvi. pp. 771, 772.*)

1. David Wallace, æt. 25, admitted August 11, 1854, on account of compound comminuted fracture of the bones of the leg. A heavy truck passed over his right leg about two P.M. The gentleman who first saw him applied a tourniquet, and had him sent into the hospital in a cart. He arrived at six P.M. He was pale, and his pulse very weak from loss of blood. On examination, the bones were found to be ground to pieces, just below the tuberosity of the tibia ; the muscles of the calf were divided and mixed up with fragments of bone ; the skin was entire, excepting on the front and on the outer side. Four oz. of brandy and $\mathfrak{z}$ i. of solution of morphia were administered. He was put under chloroform, and removed to the operating theatre, but nearly sank on the way, respiration and pulse ceasing almost wholly. He was allowed to awaken, and had two oz. of whisky as soon as he could swallow ; he was again put under chloroform, and amputation by flaps performed at the lower third of the thigh. During the operation he nearly sank. He was then removed to bed, and surrounded with hot bottles ; two oz. whisky and $\mathfrak{z}$ i. morphia were administered ; in a short time he vomited ; the morphia was repeated ; pulse 120, very weak. He rallied about three next morning, under the assiduous application of stimulants and warmth. In the afternoon the skin was warm and moist ; pallid hue gone. Ordered $\mathfrak{z}$ i. Sol. Mur. Morph., which he soon vomited ; Bismuth Alb. gr. x. He became very excited and restless ; the dressings came loose ; dry lint was applied. Three stitches were removed, as some oozing had taken place. He slept well during the night, but awoke weak and restless ; pulse 130. To have port wine $\mathfrak{z}$ ss. every hour, and Sol. Mur. Morph. $\mathfrak{z}$ i., and M. xx. every fourth hour, if necessary. The bowels were moved by enema. At five P.M. the pulse was 130, full. Slept soundly all afternoon. Sweated profusely, but felt quite comfortable. At seven P.M. he was found pale and collapsed, only semi-conscious. There was a foetid smell round the bed. There was a bluish line all around the stump above the dressings, and a row of phlyctenæ behind it ; the bandage was becoming tight. All dressings and stitches were removed. The stump, as high as the trochanters, was quite cold and emphysematous. A poultice was immediately applied all over it. Wine $\mathfrak{z}$ iv and whisky $\mathfrak{z}$ ij were given ; but the gangrene spread rapidly, and the patient died at half-past nine P.M.

No examination was allowed. Shortly after death the body became of a purplish hue, and emphysematous all over, especially the head and face.

2. Wm. G., æt. 30, was knocked down by a railway waggon, which passed over both his lower limbs. The right thigh was fractured in the lower third ; the soft parts were considerably bruised, and there was enormous

swelling from extravasation of blood into the textures of the limb. The leg was cold; no pulsation could be felt in the tibial vessels. The left leg and thigh were likewise much bruised and slightly lacerated. Amputation was performed through the upper third of the right thigh, by anterior and posterior flaps. A portion of the muscle in the stump sloughed; the ulceration extended towards the femoral artery, and on the ninth day opened into that vessel a little above the ligature, which remained attached. On raising the stump and applying cold, the hæmorrhage ceased; but it recurred six hours thereafter. Mr. Spence then cleared the vessel from the surrounding tissues, and applied a ligature above the bleeding point. The sloughs separated; the wound looked healthy, and partial adhesion had taken place; but matter formed extensively in the left thigh and leg, and, under this profuse discharge, the patient sank in the fourth week.

SECONDARY AMPUTATIONS OF THIGH FOR INJURY.

1. S. C., æt. 8, was admitted on the 15th of July with a compound fracture of the thigh between the middle and upper thirds, resulting from a fall into an area from a height of twenty feet. The wound in the integuments was very small; and the limb was placed in a long splint. Necrosis of a considerable portion of both the upper and lower fragments of the bone took place, and abscesses formed around the thigh with profuse purulent discharge. As the patient was evidently sinking from hectic caused by the profuse discharge, while the necrosed portions of bone had not separated, amputation was performed on the 26th of August, immediately below the trochanters, by antero-posterior flaps formed by transfixion. The case promised well for some time, but pyæmia set in, and death occurred on the 18th of September.

2. C. A., a strong healthy girl, æt. 16, was admitted on the 13th of July with a compound comminuted fracture of the leg, caused by a light butcher's cart having passed over the limb. Pulsation in tibials distinct; temperature of the foot good; no great bruising of soft parts. Several detached portions of bone were removed, and the limb placed in a Liston's splint. *July 17th.*—Gangrene of the limb having taken place, amputation was performed at the lower third of the thigh, by the long anterior flap. There was unusually little bleeding during the operation, and there was no sloughing or gangrene of the stump; but the patient took a rigor on the 20th, and died of pyæmia on the 29th.

3. M. J., æt. 16, while running from a ram, tripped, and fell. Her right limb lay across a narrow drain and against it the chief violence of the animal was directed. The butting against the knee was so severe as to separate the external condyle, and at the same time cause great distortion of the joint and extravasation of blood into the surrounding textures. At first the knee-joint was thought to be dislocated, and attempts were made to reduce it. She was sent into hospital next day. The limb was placed in a wire splint, and fomentations applied to the joint. For about three weeks the patient went on favourably, but the soft parts began to slough, and the joint was ultimately opened into. Thereafter, acute synovitis set in, accompanied with irritative fever and profuse unhealthy dis-

charge. In the beginning of the fifth week the symptoms assumed a hectic character. As the patient was evidently fast sinking, and as her only chance of life was amputation, the limb was removed by the modified circular method, through the middle of the thigh. She died a fortnight after the operation.

4. John B. A loaded waggon passed obliquely over his right thigh, fractured the external malleolus and astragalus, and caused great extravasation into the textures of the leg and foot. At first it was thought possible to save the limb, but by the following day it had become quite cold and perfectly numb. As it was impossible, under these circumstances, to amputate with safety below the knee, the operation was performed through the lower third of the thigh by the long anterior flap. Recovered.

Remarks.—The successful case, John B., may be considered rather as a deferred, than, properly speaking, a secondary amputation. The state of collapse in this patient rendered it doubtful whether the coldness of the injured limb might not depend upon the general depression of the circulation, rather than on the local lesions, and therefore I considered it prudent to wait until moderate reaction took place, before deciding as to the necessity for amputation.

REGIONAL SURGERY.

INJURIES OF HEAD.

LECTURE XCI.

Injuries of the Head—Anatomy of the Textures involved, viewed in its Normal and Pathological Aspects—Primary and Secondary Effects of Injuries—Wounds and Bruises of Scalp: their Varieties, Phenomena, Complications, and Treatment—Compression and Concussion of the Brain—Symptoms of Concussion: its General Treatment.

INJURIES OF THE HEAD.—Whilst each of the various forms of injury occurring in this region possesses its own peculiarities, their chief interest is derived from the effects they may induce, either primarily or secondarily, on the brain and its membranes: so that what appears at first a trifling injury may, unless carefully attended to, lead to a serious or even fatal result. Accordingly, in treating of injuries of the head, we require constantly to keep in mind the nature of the textures injured, and their relation to the brain and its membranes.

INJURIES OF THE SCALP have dangers which depend both on the character of the scalp-texture, and on its vascular connections with the cranial bones and the dura mater. The scalp is composed of several tissues closely connected. The skin is of close dense texture, and is united by slips of fibrous tissue to the occipito-frontalis, the broad tendinous or aponeurotic expansion of which forms a sort of central tendon to the anterior and posterior bellies of that muscle. The interstices between these fibrous connections are filled by a quantity of dense granular fat, and the tissues are largely supplied with blood-vessels and nerves. In the lateral region of the head, we find the strong temporal aponeurosis underlying the scalp. The deep surface of the

scalp presents a smooth layer of dense fibro-cellular structure, which is very loosely connected by a quantity of fine cellular tissues with the pericranium. This cellular tissue is largely permeated by blood-vessels, which enter the bones and communicate in the diploë with branches which ramify in the dura mater.

The anatomical structure of the scalp—its dense unyielding texture, its great vascularity and nervous supply, the large amount of fibrous and aponeurotic tissue which it contains blended intimately with the more highly organised textures, together with the vital connections existing between it and the cranial bones and membranes, have important bearings in relation to diagnosis, prognosis, and treatment of injuries occurring in the region ; and hence we always regard these, even when slight, as deserving of watchful attention.

Bruises of the scalp may prove troublesome, from the injury leading to inflammation and unhealthy suppuration, or being complicated by dangers arising from the force causing the bruise affecting the brain and its membranes, as in concussion.

The character of the swelling which follows extravasation from bruise of the scalp, deserves our attention in reference to diagnosis. If the deep surface of the scalp be ruptured and blood effused, such extravasation may and very often does spread over the whole extent of the head, causing enormous swelling on the cranium, bulging over the orbits, and posteriorly passing down towards the neck. This arises from the loose connection between the scalp and pericranium, permitting the blood to spread uninterruptedly. The appearance of the patient, in some cases, is frightful enough ; but, as a general rule, if rest be enjoined, and cold evaporating lotions applied at once, the blood is rapidly absorbed, and no bad consequences may result : the laxity of the connecting tissue allowing of great distension without injurious pressure on the pericranium and bone. Incisions to evacuate the extravasated blood can hardly be requisite, except the tension be very great, and attended with constitutional symptoms. When speaking of contusions, I have already pointed out the dangers attendant on opening collections of effused blood,

and in this region these dangers are aggravated by the close relation of the effusion to important parts. Should symptoms of inflammatory tension or of suppuration occur, then, of course, incisions are imperatively required ; and there should be no delay in making them freely, to evacuate putrid blood and pus.

In some rare cases, where the extravasation arises from rupture of a large artery, such as the occipital or temporal, a pulsatory motion is communicated to the swelling, as in false aneurism. In such cases, firm pressure applied over the trunk of the injured vessel, and cold lotions to the swelling, will generally suffice to effect a cure, without having recourse to more heroic measures.

When the extravasation takes place into the scalp-texture, instead of beneath it, the extravasation is limited, owing to the density and close connections of the different tissues forming the scalp. This peculiarity of structure gives rise to a peculiarity in the swelling, which might lead—indeed often has led—to error in diagnosis. As the extravasated blood coagulates in the interstitial texture of the scalp, the flattened swelling assumes an extreme hardness ; whilst towards its centre, where a portion of fluid blood or blood-serum exists, the swelling pits, and on pressure the finger feels as if it passed down through an opening or depression of the bone, and a depressed fracture is suspected. The diagnosis, however, is not in general difficult. If the finger be pressed firmly down, the fluid blood or serum is displaced, and the flat surface of the cranial bones is felt. The condition, however, when complicated with the existence of severe concussion or symptoms of compression, may prove perplexing, and even lead to unnecessarily active practice. When the real state of the case is ascertained, the extravasation requires very little treatment beyond perfect rest and the use of cold applications to the bruised part.

Wounds of the scalp, whether incised, punctured, or lacerated, are, from the nature of the texture wounded, more likely to be followed by erysipelatous inflammation than wounds in other parts of the body. At one time this risk was increased in consequence

of the method of treatment adopted. A great dread existed of the bad effects of sutures and ligatures in scalp wounds, and so they were dressed with pads of lint, plaster, and bandages. This excited irritation, and led to the very danger it was intended to obviate. A simple incised wound of the scalp will in general do well if treated on the same principles as any other incised wound. In all forms of scalp wounds the part should be shaved. Bleeding vessels must be secured, and as, in a dense texture like the scalp, the arteries cannot be readily drawn out to be tied, acupressure has been long employed for this purpose, and the needle used, as in harelip suture, to unite the edges of the wound. If the wound be large, points of interrupted silver suture should be used, as giving rise to little irritation, and dry cold, by means of ice in gutta-percha bags, may be applied with advantage for some time. This local treatment, combined with rest and attention to constitutional symptoms, will generally prevent the accession of erysipelas or other bad symptoms.

In punctured scalp wounds, where injury has been inflicted with some force—as for example when a person falls on a pike or a sharp-pointed stone, or when a sharp-pointed body projected with force strikes and perforates the scalp—we must be careful in our examination of the wound, as a punctured fracture of the bone (a most dangerous lesion) may be present, and would necessitate prompt and decided measures to avert bad consequences. Even in cases where there is only a punctured wound of the scalp, there is greater risk of erysipelalous inflammation or unhealthy suppuration following than in the incised wound. In such cases the proper treatment consists in applying dry cold to the part, enjoining a non-stimulating diet, and keeping the bowels freely open. Should inflammatory tension supervene, the punctured wound should be freely incised, with the view of at once relieving tension and depleting, and also of allowing any pus or putrefying blood to get free vent, poultices or warm water lint-dressing applied over the wound and neighbouring parts, until the acute stage has passed off, when gently stimulating lotions should be substituted. By

adopting the treatment I have indicated, we obviate the dangers arising from extension of erysipelas over the scalp, the lodgment of unhealthy pus and blood in the vicinity of the cranial bones, or of the important internal structures becoming affected by the continuity of vascular supply.

Lacerated scalp wounds are of very common occurrence, and unless carefully treated and watched may prove very serious. In many cases such wounds are very extensive, and present a most frightful and ghastly appearance. It does not, however, follow that these very extensive wounds are always the most dangerous, and we require to consider the whole circumstances to form some estimate of the risk in each case. A reference to what has been already said of the anatomy of the scalp will explain the peculiarities of such wounds. The close connection of the different textures composing the scalp, and the resistant character of the aponeurotic structure which enters so largely into its composition, may account for the circumstance that we rarely find large portions of the scalp torn away, even when the parts are much lacerated, as by machinery ; whilst the loose connection it has with the pericranium, admits of it being readily detached from the subjacent structures over a large surface without such injury as would impair its vitality. This also explains why it fortunately happens that the pericranium is seldom detached to any great extent in such wounds. Thus we often see half of the scalp stripped from the cranium, and hanging over the face or side of the head, and yet wonderfully little constitutional disturbance follows, and the wound, if properly treated, heals kindly. The treatment of lacerated wounds of the scalp must be conducted on the general principles laid down when speaking of lacerated wounds, bearing in mind the peculiarities of structure and connection already alluded to. In most cases of this kind, we find the torn and everted scalp covered with mud or dirt, as such injuries usually occur in consequence of persons falling from horseback and being dragged along the road, or from the head coming in contact with the wheel of a passing carriage or cart, or from the hair getting entangled in machinery. The injured scalp

and cranial surface require to be cleansed from all foreign substances, and then the scalp should be carefully re-adjusted, and maintained in position by points of silver wire suture. At one time this, as I have already said, was greatly objected to as being likely to cause erysipelas ; but it is less likely to cause irritation than heavy dressings of plasters, pads of lint, and complex bandages. The surgeon sees the progress of the wound, and can remove any sutures that seem irritable. Discharge is prevented from accumulating ; a piece of lint soaked in tepid water or some antiseptic lotion is merely laid over the part, and the patient is thus saved much pain and discomfort. Sutures I have used long before the introduction of silver wire sutures, and I never saw any irritation follow even when the ordinary silk was used ; and though we do not expect such wounds to heal by the first intention, the sutures maintain the detached scalp in position until it gets 'a set,' if I may so speak. Whereas, if we do not employ stitches, the scalp falls away, contracts upon itself, and leaves a large gap ; the edges of the wounded scalp become thick and everted ; the healing process is very slow, and occasionally ulceration of the pericranium with head symptoms may arise in a scalp wound from neglect of accurate apposition at the first.

In cases where the scalp is contused and torn rather than detached, as in injuries inflicted with blunt weapons, the local treatment at first is the least important. Warm water lint-dressing should be applied to the wound at first, and simple or charcoal poultices afterwards, when suppuration or sloughing supervene. In such cases we require to be specially on the watch for the development of head symptoms, especially those which indicate suppuration within the cranium. Erysipelas with smart fever and delirium may occur, and often does so without great danger. The most dangerous cases are those in which all seems to be going on favourably until about the eighth or tenth day, when the patient complains of not feeling so well ; then a distinct rigor or repeated chills are felt, followed by headache and a low delirium ; the edges of the wound become glazed and everted, or the scalp around has a puffy appearance, and the bone is seen bare. The

delirium increases, and gradually the patient becomes comatose. In such cases there has probably been suppuration between the bone and dura mater, resulting from the continuity of vascular supply between that structure and the scalp. This result is liable to occur in all forms of scalp wound, and is one of the cases where the operation of trepan may be required to evacuate the pus ; but of this I shall have to speak hereafter.

In cases where a contused or lacerated wound of the scalp is in the vicinity of or involves a large artery like the temporal or occipital, without actually wounding the vessel, if the wound takes on an unhealthy action, secondary hæmorrhage may result from ulceration of vessel. As this may occur suddenly, we should secure the patient against the risk by placing an acupuncture needle below the artery at a healthy part, and this in no way interferes with the ordinary dressing of the wound.

In all cases of scalp wounds, when erysipelatous inflammation attended with much tension, supervenes, incisions must be made into the swollen scalp, and warm fomentations, such as those of chamomile flowers and hops applied to the head. Abscesses in or under the scalp texture must be opened early and freely, and the constitutional symptoms watched, and met by appropriate treatment.

Before proceeding to speak of the injuries of the cranial bones, it is necessary to consider the effects produced by the shock of force communicated to the brain, or those produced by laceration or compression of its substance, as these effects on the contained organs constitute the important feature in all forms of head injury.

There are two conditions, CONCUSSION and COMPRESSION, which we require specially to consider. These conditions are very different in their essential nature ; but the symptoms on which our diagnosis must be founded are not always well defined, owing to the less serious condition being often complicated with other lesions.

Concussion, pure and simple, means the effect produced on the brain substance and its circulation from the shock of a blow

fall, or other injury, without any recognisable lesion of its structure. By compression is understood the direct and obvious compression of the brain substance and its circulation, whether by depressed bone, as in fracture of the skull, or by fluids, such as blood, serum, or pus, effused within the cranium. In a case of simple concussion of the brain, the patient is insensible, the pulse weak, fluttering, and irregular. The respiration is also irregular, slower perhaps than usual, but not stertorous. The surface of the body is cold, the limbs are flaccid, and there is occasionally loss of power of the sphincter ani, and either retention or involuntary passage of urine. The pupils are not regularly affected; sometimes they are dilated, at others contracted, and occasionally one pupil is dilated and the other contracted. The general appearance of the patient, immediately after the injury, is that of extreme collapse, with insensibility more or less complete.

The insensibility of concussion, as contrasted with that of compression, differs in degree. In both cases the patient is unconscious, but, in concussion, the patient can be roused to indicate a perception of external stimuli; thus, by speaking loudly to him, he will try and respond, not by a coherent or even a very articulate answer, but still sufficiently to indicate a certain amount of consciousness. In complete compression the patient is comatose. There is no response to external stimuli, beyond the mere existence of irritability excited by those of a physical nature. Another difference is in the evanescence of the unconsciousness in concussion as compared with compression. In the former the insensibility naturally tends to pass away, unassisted by remedies, consciousness gradually returning. The first stage of concussion, or concussion proper, may last from a few minutes up to some hours. Gradually the pulse rises, the respiration becomes more regular, and the heat of surface returns. The patient becomes a little restless, and at last opens his eyes as a person awakened from a troubled sleep, stares round him, and after a time becomes sensible of his position. At the beginning of this second stage, as the insensibility begins to pass off, the patient

very generally vomits. Occasionally vomiting occurs immediately after the accident, but this is rare. The vomiting, in fact, is an evidence of the existence of some degree of sensibility.

After a short period, during which the patient seems restored to his natural health, another train of symptoms manifest themselves. The pulse becomes quick, sometimes hard and wiry, the skin hot and burning, and the patient complains of headache and thirst. Reactionary fever has set in. Such is the usual course of the phenomena observed in a case of concussion, when unaccompanied by any lesion of the brain, its membranes or their blood-vessels. When, on reaction, the circulation becomes excited, other symptoms may develop themselves; vessels which have been torn may then begin to bleed, and lead to compression of the brain; or inflammation of the brain or its membranes may supervene, and occasionally give rise to compression caused by effusion of lymph, serum, or purulent matter within the cranium; but these are effects which require to be considered specially.

The explanation of the symptoms in pure concussion is not very easy. These symptoms seem dependent on some temporary derangement of the brain substance, or its circulation, giving rise to functional disturbance of the sensorium, which gradually passes off with the subsidence of the shock which caused it. In cases where the symptoms are more severe and persistent, or lead to any permanent change in the mental or physical condition of the patient, we may infer that some organic lesion has complicated the injury. This view is borne out by what we see in cases of concussion, which terminate fatally, where usually laceration of the brain substance, or extravasation of blood into the brain is found. In the very rare cases where concussion terminates fatally without reaction occurring, and in which no obvious lesion is found, it is probable that the shock has affected not only the sensorium but also that portion of the nerve centres more essentially concerned in organic life. The late Mr. Vincent was of opinion, that the amount of danger in cases of concussion depended on the direction as well as on the degree of

the force causing the injury ; being greatest when transmitted in a line directed towards the base of the cranium, by which its effect is received on the central parts of the brain, and least when directed in a line at right angles to the vertical lines, the force being then transmitted from side to side on the upper part of the brain, producing but little disturbance of its functions. (See diagram, Fig. 1, Plate xlv.)

Concussion of the brain, when uncomplicated with organic lesion, rarely proves fatal in the early stage ; the dangers are chiefly due to those conditions which develop themselves during reaction, and it is against such that you must be on your guard ; but the treatment of the early stage of shock has important bearings on the after-risks, as it may influence materially the subsequent conditions.

First let me state succinctly and distinctly what I consider should be the treatment, and I will then give you my reasons for avoiding certain things which are sometimes done. Amongst the most important items of treatment are the abstaining from all avoidable movement of the patient, and maintaining him perfectly quiet. External warmth should be applied by means of hot bottles or heated bricks wrapped in flannel ; a sinapism may be applied to the epigastrium, and if the collapse is considerable, and the symptoms do not soon improve, a turpentine enema should be administered, which acts as a stimulus, and at the same time relieves the bowels if distended. No internal stimulants should be administered at this stage, unless in very exceptional circumstances. If we attempt to give them in the unconscious state of the patient, unless we use the stomach-tube, there is a chance of suffocation from inability to swallow, and if we administer stimulants by means of the tube we are liable to increase the violence of the reactionary stage and the risks incident to that. The opposite and even more dangerous interference by bleeding during this early stage of concussion is not so likely to be used as it once was. There are certain conditions supervening on concussion, in which depletion is indicated and is followed by marked benefit. But to withdraw

blood when, from the shock to the nervous system, the circulation is depressed and irregular, and life trembling in the balance, would be very likely to turn the scale the wrong way. I know there are cases on record where venesection has been practised in the first stage of concussion with apparently immediate relief; and I can quite understand that in a case of concussion in which the right side of the heart was distended, venesection might, by relieving the distended organ, benefit the patient; but the case would be marked by congestion of the veins of the neck. Besides, the risks are so evident and so great, that I think it safer to advise you to abstain from so dangerous a remedy. When reaction has fairly set in, absolute quietude must be enjoined, and prophylactic measures used to ward off over-excitement, and the effects which frequently follow concussion. Cold, by means of ice-bags or cold-water cloths, should be applied to the head, and hot bottles kept at the feet. The patient should be put on low diet, and the bowels kept freely open. Should the pulse become quick and hard, accompanied with headache, or very slow and laboured, with sluggish action of the iris, depletion should at once be employed, either by venesection, or by leeches applied behind the ears. The patient should be carefully watched, and any abnormal conditions met by appropriate treatment.

LECTURE XCII.

Rationale of Treatment of Head Injuries founded upon the Pathological Conditions attending them—The immediate and more remote Dangers following Reaction in Concussion : Symptoms attending them ; Indications to be derived from these—Active and Passive Extravasation : Diagnosis of its Site—Inflammation of the Brain and its Membranes—Suppuration within the Cranium—Evacuation of the Pus by Perforation.

I HAVE stated dogmatically the treatment which experience has convinced me to be that best suited to ward off subsequent evils, because I think that in cases of emergency it is well that young practitioners should have the general plan of treatment before them in a distinct and easily remembered form. But to enable you to understand the grounds on which the method of treatment is founded, requires me to proceed now to consider the dangers which are liable to follow on concussion, during or subsequent to the reactionary stage. These dangers are, first, internal hæmorrhage, in either an active or passive form, leading to compression or disease of the brain. Secondly, inflammation of the brain or its membranes, resulting in effusion of serum or coagulable lymph on the surface of the brain, softening of the brain substance, or the formation of purulent matter within the cranium.

The danger which is likely to follow most immediately during reaction, or after it is fairly established, is INTRACRANIAL HÆMORRHAGE, and I shall therefore begin by considering its causes and effects. The cause of intracranial extravasation in concussion may be said in general terms to be rupture of some blood-vessels, generally of small size, by the force which caused the concussion. During the state of shock and collapse the depressed state of the circulation prevents active bleeding ; but when reaction commences and proceeds, the circulation becomes excited, and then the ruptured vessels pour out their contents,

and lead to symptoms, the character of which will depend on the amount and site of the extravasated blood. If the extravasation be small in amount and situated in the brain substance, or on the surface of the brain, or in a thin layer within the arachnoid membrane, the symptoms at first may not be very urgent or marked, and any symptoms which have appeared may seem to pass off; yet the extravasated blood may, by exciting a chronic inflammatory action, lead to disease of the brain, and at a later period give rise to alteration in its functions, as evidenced by both objective and subjective symptoms, such as impaired vision, paralysis more or less complete of parts supplied by some of the intracranial nerves, loss of memory, or other mental disturbance, imbecility, or excitability.

The cases in which the urgent symptoms following concussion mark most clearly the occurrence of intracranial extravasation, are those in which the meningeal vessels are ruptured. In such cases the force causing the injury has separated the dura mater from the cranial bones at the point where the blow was received, or at the opposite part of the cranium, by the *contre-coup*. The minute or larger vascular connections between the bone and membranes are ruptured, and pour out their contents. These press inwards the dura mater, and the corresponding hemisphere of the brain, causing symptoms of compression. Such a case affords, of all

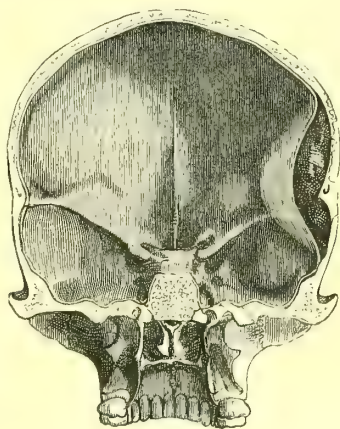


Fig. 3.

others, the best example of compression; and following, as the symptoms do, upon those of concussion, the distinctive characters and points of contrast between the two conditions are best studied. Suppose a case of concussion in which gradually the symptoms of insensibility and collapse have passed off. Moderate

reaction has occurred, and the patient has answered questions rationally, and expressed himself free from uneasiness. As reaction proceeds, the pulse rises, the face becomes flushed, and he complains of headache, and, perhaps, some sensation of noise as of rushing water, and becomes hot and restless. By and by he falls into a troubled sleep ; gradually he becomes still, the sleep is noticed to be profound, and he snores deeply. At length the appearance of the features or the noisy character of the breathing alarms the friends, and they try to rouse him, but in vain, and the medical attendant is summoned. He finds the patient's pulse slow and laboured, the breathing stertorous, the pupils of the eyes dilated and insensible to light, and the eyelids and eyes insensible to the touch. The limbs are flaccid, though, in some cases, occasional convulsions and subsultus tendinum occur. The sphincters are relaxed, the patient passes his stools and urine involuntarily, or complete retention of urine takes place from loss of expulsive power. No noise, or question, however loudly put, nor even external stimulus, can rouse the patient, the state of coma being complete. In such a case the train of symptoms enables us to trace cause and effect. The original shock to the cranium, the insensibility caused by that passing away, the interval of consciousness, the excited circulation of reaction, followed by the gradually increasing coma of compression, leave no doubt as to what has taken place. It is a case of active intracranial hæmorrhage, leading to compression of the brain. Such a case points to the necessity for the watchful care and the prophylactic measures I have indicated during the stage of reaction following concussion.

The course and nature of the symptoms in this form of extravasation are so marked as to arrest the attention of even a careless observer. There is, however, another and more insidious form, that of *Passive* extravasation, of which I have seen many cases, and to the dangers and treatment of which I drew attention long ago, but more specially in my Clinical Report for 1859-60. This passive hæmorrhage very generally occurs from injury of some of the venous sinuses, but also from the smaller meningeal

Fig 1



Fig 2



Fig 3

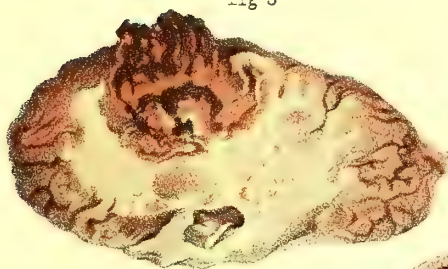


Fig 4





arteries. Its progress is insidious, and unless we are on the watch for danger, there is nothing in the appearance of the patient which would excite alarm. Generally, he seems to be suffering little from the injury ; complains, perhaps, of occasional headache, followed by a dull, uneasy sensation. If we examine carefully, we find that the pulse either never rises to the natural standard after the first stage of concussion has passed off, or what is more common, after having regained its natural frequency, it begins to fall to 60, 52, or 40 beats per minute ; this decrease following in a marked manner the occasional attacks of headache. The pupils become rather dilated, and, if tested by the application of light, contract in a sluggish and irregular manner. If these conditions be unnoticed or neglected, the patient, after the lapse of some days, may gradually become comatose ; or, more generally, excitement, delirium, squinting, and convulsions, precede by a few hours the symptoms of compression, which close the scene. The great danger in these cases is, as I have already said, that, owing to the slight general symptoms, and the trifling alterations in the state of the pulse in the early stages, the surgeon may neglect to guard against subsequent reaction, with its accompanying extravasation.

From what I have seen in the *post-mortem* examinations of cases in which the progress was such as I have described, I believe that the symptoms are due to a passive form of extravasation occurring at different times. Perhaps a certain amount of blood may have been poured out at the time of the accident, or slowly as the shock passed off, causing a slighter form of compression, as indicated by the somewhat dilated and sluggish pupil and the slow oppressed pulse. If no more extravasation occur, the symptoms may pass off without further bad effects ; but if the patient, feeling not very ill, be excited in any way, or allowed to move about, attacks of headache ensue. Each attack, attended by falling of the pulse, and greater dilatation and sluggishness of the pupil, marks the further effusion of blood. Next, the clot so increased in bulk, may, by its presence, excite irritation of the brain and its membranes ; and then we have the delirium and squinting

without apparent excitement of the pulse ; but soon, as the escape of blood becomes more rapid from the restlessly excited state of the patient, sudden convulsions followed by complete compression result. In one fatal case, where the original injury was stated to be very slight, and where the patient could scarcely be made to see the necessity for any treatment, death occurred on the fifteenth day after the injury, preceded by excitement suddenly terminating in compression. On examination I found an enormous amount of blood effused, the greater portion of the mass being quite soft and evidently recent ; whilst other portions, varying in consistence, showed that the extravasation had occurred at different times.*

Connecting these *post-mortem* appearances with the train of symptoms observed in such cases, I have long considered the slow oppressed pulse and sluggish pupil, especially when preceded by fits of headache, and the sensation described by patients, as being like a “rushing sound or feeling” in the head, as indications for diminishing the force of the cerebral circulation, so as to prevent further extravasation. The means I use to fulfil this indication are, depletion by means of leeches applied to the mastoid region ; venesection in severe cases, or where the patient is young and strong ; cold applications to the head, and free purgation. In a great many cases, if leeches be applied to the mastoid region, when the pulse is first noticed becoming slow, after reaction has been established, they will be found sufficient, if combined with cold to the head and the use of purgatives ; but if the symptoms threaten to recur, the leeching should be repeated. In severe cases I have found most decided benefit from venesection, in alleviating the dull headache and tendency to coma, at the same time relieving the cerebral oppression, as evidenced by the slow, laboured pulse soon becoming more normal, and by the rapid improvement of all the other symptoms. In young and robust persons I have repeated the bleeding with advantage ; but even in those of more advanced age or weaker constitution, it may be practised with perfect safety, if

* See Clinical Cases.

we carefully watch its effects, seeing that we can arrest the depletion when we please.

If antimony could be employed without the risk of inducing vomiting, it would be serviceable in preventing reaction after depletion; but, unfortunately, even in minute doses, it is so uncertain in this respect, that I seldom have recourse to it.

At a more remote period after the injury has been received—from the fifteenth to the twentieth day, or later—a similar train of symptoms, though less marked, sets in, depending, I believe, upon serous effusion from subacute or chronic congestion of the vessels of the membranes. In those cases, blisters to the nape of the neck or occipital region, combined with the use of mercurials and laxatives, will generally be found the most efficacious plan of treatment; but even at this stage I have occasionally had recourse to leeches with great benefit.

In regard to the position of the extravasated blood, in all forms of intracranial hæmorrhage, that is very uncertain. It may be between the bone and dura mater at the part struck, or at the point directly opposite, on the other side of the cranium, or it may be within the membranes of the brain, or in the substance of the brain. In the cases where the blood is poured out between the bone and dura mater, the clot is more localised and circumscribed, and within reach of surgical interference, if only we had some definite indication of its position.* In general, the urgency of the symptoms and the position of the seat of the injury, in relation to the middle meningeal artery or its branches, form the only warrant for the surgeon to have recourse to the operation of trephine to enable him to remove the clot, and so relieve the brain, but there must always be uncertainty. In a case of active intracranial hæmorrhage, where the compression is complete and no amelioration follows the use of remedies, such as cold applications, depletion, and purgation, and where the seat of the injury is over or near the line of a large meningeal vessel, the operation ought to be resorted to as giving a chance for life. If the extravasation were not found there, I would even go the length of repeating the perforation at the point of contre-

coup ; but when the extravasation is within the membranes, the blood is so diffused towards the base of the brain that it could not be removed even if found, and hence operative measures are unwarrantable.

INFLAMMATION OF THE BRAIN OR ITS MEMBRANES, as a consequence of concussion, is the other danger which we have to guard against. In such cases, the train of symptoms and the period at which they supervene, are, in general, sufficiently diagnostic. Even in the passive form of extravasation, which I have alluded to, although some of the symptoms are those of excitement, and though the more marked symptoms of extravasation occur at a later period than in cases of active intracranial hæmorrhage, yet, when we are on the watch, the indications of extravasation are evident from the symptoms at an early period after reaction ; whereas, in the case of inflammation of the cerebral membranes or substance, the symptoms never appear immediately after reaction is established ; but generally from the sixth to the tenth day—seldom before the eighth day. Up to that date, the patient probably progresses well, complaining little of uneasiness beyond occasional attacks of headache, and without any great increase in the frequency of the pulse. The most common premonitory symptoms are anxious expression and sleeplessness, though these are not always present. About the sixth day the patient feels rather out of sorts, his appetite fails, the tongue is white and loaded, and he complains of headache, the character of which he describes as if a cord were tied round the head ; or else he complains of feeling a general tension about the head. The skin becomes hot and dry, and he has either a slight or well-marked rigor. The pulse becomes hard, wiry, and very frequent. Then follow intolerance of light and sound, and all the other symptoms of fever. The patient has an excited look, the eyes are restless and brilliant, and he starts and speaks during sleep. Delirium, generally of a violent frenzied character, supervenes. This state of matters, unless it yields to treatment, goes on increasingly, till it gradually terminates in low muttering delirium and coma. In some

cases, the symptoms indicate the formation of purulent matter within the cranium. After the phrenitic symptoms have lasted for some time, usually about the tenth or twelfth day from the receipt of the injury, a very decided rigor occurs, succeeded by perspiration. The general febrile symptoms are less, but there is a tendency to low muttering delirium, a semi-comatose state. Not unfrequently, paralysis, in the form of hemiplegia, or of some particular set of nerves, such as the facial, makes its appearance, and there are convulsions, subsultus tendinum, and these culminate in symptoms of compression.

These latter symptoms may arise either from effusion of serum or lymph on the surface of the brain or into the ventricles, or from suppuration and effusion of purulent matter between the bones and dura mater, or into the cavity of the arachnoid. In the cases where the effusion is either into the cavity of the arachnoid or sub-arachnoid, any surgical interference can be of little use, as the fluid, whether serous or sero-purulent, is generally diffused, and cannot be thoroughly evacuated. When, however, it is situated between the bone and dura mater, it is more likely to be localised, and may be evacuated by operation. It is therefore of importance to note any indication which may guide us to the position of the effused matter. Unfortunately, such indications as we have are neither very decided nor satisfactory as to the exact locality of the effusion. Hemiplegia is so far a general indication as evidencing pressure on the brain, and it is also usually indicative that the matter is situated over the hemisphere of the brain opposite to the paralysed side ; yet, in several cases, the contrary has been found to be the case ; and again, it may arise from sub-arachnoid effusion, or abscess in the brain substance itself. Mr. Pott, in his great work on injuries of the head, drew attention to the state of the scalp in certain cases, as indicating, in conjunction with the other symptoms, the position of pus, when placed between the bone and dura mater. He stated that in such cases the suppuration between the bone and dura mater affected the vitality of the bone ; and that, owing to vascular connections, the pericranium would also suffer, and

hence that unhealthy suppuration would occur under the scalp at the affected point. That in such cases, if the scalp was entire, a puffy or boggy tumour occurred at the part, or if a wound of the scalp existed, as the internal diseased action proceeded, the external wound became unhealthy, its edges everted, the discharge thin and gleety, and the bone could be seen bare at the bottom of the wound, and that the intracranial suppuration would be found to correspond. The "puffy tumour" of Pott has not been considered by recent authors as being much to be depended on as a diagnostic, and is spoken of as being rarely met with. My experience has been different. I have had occasion to trephine in several cases for purulent matter, and in these cases, one or other of the conditions described by Pott served as my guide to the pus. I suspect the term "puffy tumour" may possibly have led some to expect the presence of a distinct prominent swelling. In some cases it is so, but most generally it is merely a boggy tumefaction or flattened swelling under and in the scalp tissue at the part corresponding to the internal collection of pus.

As regards the value of the indications alluded to, it must be obvious that they are not absolutely certain. A simple contusion of the scalp tissue may be followed by suppuration of unhealthy character, and give rise to a boggy swelling; or a scalp wound, in which the pericranium has suffered, may be followed by necrosis of the surface of the bone, and then the wound would present the unhealthy appearance described, and it may so happen that the general head symptoms may be coincident with such local symptoms. It is quite true that suppuration between the bone and dura mater may occur without these local conditions, and also, that when they are present, perforation of the cranium may disclose nothing beyond a sloughy state of the dura mater, and perhaps a thin layer of yellow lymph, scarcely purulent matter. Still, as a general practical rule, if we have the symptoms of intracranial suppuration, and one or other of these local conditions be present, they form the best guides the surgeon has as to the position of the suspected purulent collection. My own opinion is, that the

cases in which these local conditions described by Pott exist, are cases in which the cranial bone and its pericranium have suffered severe contusion, followed by inflammation of the internal membrane, and hence the distinctly localised result ; whilst, in cases where general meningitis follows concussion and terminates in suppuration between the bone and dura mater, these local indications may be absent.

The *Treatment* of inflammation of the brain or its membranes requires to be active, and to be successful must deal with the disease in its early stage. Indeed, here, as in regard to intracranial extravasation, prophylactic treatment during and after the stage of reaction is that which is of most avail ; and hence the surgeon should never look on any injury of the head as too slight for anxiety and watchfulness. He ought always to bear in mind, that the diseased condition may supervene very insidiously, and that the diagnostic symptoms rarely occur till a week or ten days after the injury, sometimes much later ; hence the necessity for quiet, and careful regimen, even when all seems going on favourably.

In the early stage of meningeal inflammation, the most perfect quietude is essential, and the light of the apartment should be subdued. Cold applications, such as ice-bags, or iced-water cloths, should be kept at the head. The bowels should be thoroughly cleared out by a purgative and an enema, and subsequently alterative doses of calomel or grey powder may be occasionally prescribed with advantage. When the headache is severe, and the face flushed, depletion by means of leeches, or even by venesection, should be had recourse to ; for, however unfashionable the practice may now be, I know from experience that it relieves congestion and affords relief. The assistance of antimony can rarely be obtained, as it is apt to induce vomiting. Aconite (Fleming's tincture), in small doses of a drop, or half a drop, in water, every three hours, may be used with greater safety, to keep down the circulation after the depletion. When the restlessness is very great, and there is delirium and excitement, opiates may be given with advantage, though, as a general rule,

we wish to avoid their use in head cases. In several instances of watchfulness, restlessness, and delirium, I have found excellent results follow the use of bromide of potassium in large doses and I prefer it to opium in such cases. In the later stages of the diseased action, when we have muttering delirium, slight paralysis, or a tendency to coma, and in which the originally contracted pupils have become dilated, and do not answer readily to the stimulus of light—in other words, when we have reason to suspect effusion either of serum or lymph—the use of a blister to the nape of the neck, or over the scalp, produces often very marked benefit, and it should be applied before the symptoms have made much progress. Mercurials may also be of use in this stage, to promote absorption of any plastic effusion. The diet requires to be carefully attended to. At first it should be strictly antiphlogistic, but in the later stages we often require to give stimulants and animal soup to support the patient ; and, in most cases, when the more urgent symptoms have been subdued and the tongue become tolerably clean, the exhibition of quinine as a tonic will be found of great service in promoting convalescence, and relieving the peculiar nervous headache which is generally present. The quinine should be given in small doses at first, combined with dilute nitric or nitro-muriatic acid, and the dose gradually increased up to three or four grains twice or thrice a day.

When the symptoms arise which indicate that the inflammatory action has terminated in suppuration within the cranium, we must consider whether we can by perforation of the cranium reach and evacuate the pus. I have already pointed out the two conditions which, in my opinion, form the best guides as to the locality of the purulent collection, when situated between the bone and the dura mater. When we have either the puffy tumour or the unhealthy wound and bare bone at the site of injury, or even when there is tenderness of the scalp at one point, as evidenced by the effect of pressure, and when the symptoms are evidently progressing unfavourably, I think our plain duty is to give the patient what little chance

there is for life, and his chance will be all the better that we do not delay the operation too long. If we wait till symptoms of complete compression arise, we wait too long. The amount of pus present is very seldom such as would cause compression of itself, and when that condition supervenes, in connection with suppuration, it will be found to be chiefly due to the inflammation extending to the arachnoid and pia mater, and leading to serous or plastic effusion on the surface and into the ventricles of the brain, and not to the purulent collection between the bone and dura mater. Indeed, so far as I have noticed, the symptoms of complete compression are rarely if ever present in such cases till just before death. The symptoms are generally semi-consciousness, irritability, and occasional convulsions or facial paralysis, together with the severe rigors which precede these symptoms and recur from time to time.

Even under the most favourable circumstances, the operation of trepan, when performed for the purpose of evacuating intracranial purulent collections, cannot be expected to furnish many successful results. The very existence of pus, and the symptoms which warrant the surgeon in performing the operation, indicate that inflammation of the membranes has been proceeding for some time, and argue the existence of such morbid processes as are most unfavourable as regards the prospect of recovery. Even when we find and evacuate a purulent collection between the bone and membrane, we can never be sure whether, or to what extent, the brain itself may have suffered from the diseased action. Hence the operation can only be regarded as a chance afforded to a patient under otherwise desperate circumstances. But we must take care that we give that chance for life in good time, and not wait till there is no reasonable hope left, and when the result can only bring discredit on the operation.

In one case, on which I operated early, and where the symptoms had not fully developed themselves, only a very little sero-purulent matter escaped, yet the patient mended from the time of the operation.

In speaking of the conditions of concussion and compression,

I have, for the sake of description, taken typical cases of each ; but I stated at first, that we frequently meet with cases of severe concussion, in which the symptoms are not easily distinguished from those of compression. Thus, in some cases of concussion, the insensibility is very profound, and the pupils dilated, and the patient passes his stools and urine involuntarily. In other cases, we have the deep unconsciousness, together with convulsions and strabismus. Such symptoms indicate pretty clearly that there is something more than mere cerebral shock ; that there is either lesion of the brain substance, or that some extravasation has taken place at the time of the injury, and hence the mixture of symptoms of compression with those of concussion. In cases in which convulsions and strabismus are marked symptoms, whether after concussion or fracture of the cranium, they indicate laceration of the brain substance, generally towards the centre or base of the organ, and the result is almost uniformly fatal.

LECTURE XCIII.

Injuries of the Cranial Bones—Contusions—Fractures—Ecrasement or Smash—
Fractures with and without Depression, as Fissures, and Simple, Compound,
Compound Comminuted, and Punctured Fractures—Fractures of Base of
Skull—General Symptoms and Treatment exemplified by Cases.

THE effects of injuries of the cranial bones come next to be considered. For the sake of brevity, I shall treat of them under the heads of Contusion and Fracture.

CONTUSION OF THE CRANIAL BONES is almost invariably combined with more or less severe concussion, and it may be attended by internal extravasation and other results of concussion already alluded to. More especially, I believe it to be the form of injury most likely to lead to suppuration between the bone and dura mater, in consequence of the impaired vitality of the bone, and its separation from the pericranial and meningeal connections, giving rise to unhealthy action. These conditions having been already fully considered, I will, under this head, merely allude to the fact, that contusion of the cranial bones, apart from the more immediate and urgent conditions already spoken of, may give rise to chronic affections of a serious nature, from cario-necrosis of the injured bone leading to alteration of the membranes of the brain and erysipeloid affections of the scalp ; or, the injured bone may become thickened, or irregularly nodulated on its internal surface, so as to press upon and excite chronic disease of the brain itself. In such cases epileptic attacks are very commonly the result ; and occasionally intermittent maniacal symptoms supervene, when, from any exciting cause, an exacerbation of the chronic otitis is induced.

I need hardly say, that when once such a state of matters is established, our remedies are not very efficacious, and that we

must trust chiefly to the prophylactic measures recommended when treating of the effects of concussion ; and to the active treatment of the early or acute stage of the inflammation which follows the contusion. In cases of chronic cranial osteitis following contusion, in which, from the attacks of headache and excitement, and the external tenderness of the scalp and bone, we suspect or ascertain that bone is the seat of inflammatory thickening, depletion by leeches, or, better still, by incisions through the scalp over the affected bone, will be found to afford great relief and, if followed up by the use of a course of iodide of potassium, and, at a later period, by the application of repeated blisters, permanent benefit may be effected. In certain cases, where epileptic fits have followed contusion of the bone, and especially if there be marked tenderness on pressure, or a tendency to the fits being induced by such pressure, the operation of trephining the bone, with a view of removing the source of cerebral irritation, has occasionally succeeded in effecting a cure ; but it has frequently failed ; and, as the risk of a fatal issue is considerable, I would not counsel you to have recourse to it except in severe cases, when the local irritation is well marked.

FRACTURE OF THE CRANIUM, even in its slightest form, is an injury attended with very great risk, because the existence of such a lesion indicates an amount of force applied to the cranium which would be likely to lead to serious results. It is well, however, to bear in mind, in reference to fractures of the cranial bones, that there is nothing peculiarly dangerous in the fracture itself, but that the danger is owing to the relation of the injured bone to the brain, and that this consideration is what influences our treatment of such injuries.

Fractures of the cranium are classified according to their position or character. Thus, in reference to position, we have them divided into fractures of the cranial vault, and fractures of the base of the cranium—an important classification practically, as the former division includes fractures of those portions of the skull which admit of direct surgical interference by operative

procedure ; the latter, those in which our treatment is limited to indirect measures, owing to the position of the injury.

The classification of fractures of the skull, according to their characters, includes, first, their condition as simple or compound, conditions which, though important in all fractures, are very specially so in cranial fractures, as influencing in a marked manner our treatment of the cases. Lastly, the subdivisions of cranial fractures founded upon their peculiar characters, are—fracture without depression, which includes the different degrees of fissure ; simple fracture with depression ; compound fracture, with depression ; and compound comminuted fracture with depression ; punctured or stellate fracture ; and lastly, what is termed by French surgeons *ecrasement* or *smash*, extensive comminuted fracture of the cranium. Fracture of one of the tables of the skull may occur without fracture of the other, and occasionally it happens that the internal is the table injured, whilst the outer has escaped injury.

Fissure of the bones of the cranial vault varies from a mere capillary fissure to a fissured fracture without depression, extending throughout the whole length and thickness of one of the bones, or even passing through several bones and the connecting sutures. Such an injury may be followed by grave danger, from the force which inflicted it affecting the contained organs, and leading to intra-cranial extravasation or inflammation. Hence a necessity for prophylactic measures, and for watching the patient for some time in case of mischief arising. But a fissured fracture neither admits of nor requires any interference with the fractured bone, except in cases in which compression from extravasation occurs, and in which the fissure traverses the course of a large blood-vessel,—as for example, a fissure through the anterior and lower part of the parietal bone. In that case, the existence of the fissure is a warrant for trephining, with the view of removing the extravasated blood. In cases of fissured fracture, we sometimes find the fissure at the opposite point of the vault from that on which the injury was received ; and not unfrequently we have fissure both at the point struck

and at the opposite side. Fracture without depression is merely a severe form of fissure.

The importance of depression in fracture of the cranium, whether simple or compound, is in proportion to the amount of displacement in the level of the bone, and consequent pressure on the brain. The extent of the depressed surface does not seem to affect the cerebral functions so much as the abrupt depression of a smaller portion, and does not in general so urgently demand operative interference. It is wonderful how the brain seems gradually to accommodate itself to a very considerable depression, diffused over a large surface, unless the depression be very deep. In children and young persons, the cranial bones are soft and elastic, and after a time, regain nearly their normal level; but, even in adults, the effects produced by depression of a large surface, are less severe and more transitory than we might expect, and this is one reason which causes the surgeon to be chary in trephining in such cases until other means have been tried. In simple fractures of this kind, especially in the young, no interference is warrantable at first, unless the symptoms of compression are very urgent, and resist other treatment. In such cases it will generally be found, that along with the depression of the bone, there is extravasation of blood. Indeed, the result of my own experience makes me doubt whether the displacement of the bone, in any ordinary depressed fracture of the vault of the cranium, ever causes complete compression. In many cases which I have seen, both of simple and compound fractures, with even abrupt depression, the symptoms of compression have been almost absent, and in none have they been so well marked as they are in cases of active intra-cranial hæmorrhage, whilst in others, in which the symptoms of compression increased and proved fatal, extravasation was uniformly present. In these last cases, indeed, the very progress of the symptoms enabled me to predict confidently that we would find extravasation superadded to the fracture.

In fractures at the base of the cranium, the case is somewhat different, for in such injuries the broken bones are projected upwards, and impinge directly on the most important parts of the

brain, and so may produce more urgent symptoms ; but here, also, besides the fracture, there is usually extravasation from injury of the vessels at the base of the skull.

Simple fracture with depression varies in degree, and the intensity of the symptoms of cerebral lesion or of compression will depend, as I have just said, partly on the extent, but principally on the depth of the depression, and whether it be complicated with intracranial extravasation or fissure extending from the fracture towards or through the base of the skull. When limited, and the depression not deep and uncomplicated with internal hæmorrhage, the symptoms present at first may be merely those of concussion, or of a very slight degree of compression, which, under treatment, will pass away. If, in such a case, the symptoms, instead of diminishing, gradually assume the more decided characters of compression, this increase is pretty clear evidence that the cause of the increased compression is due to extravasation of blood from lacerated vessels, and not to the fracture, as the compression caused by the depressed bone would take place at once and not increase. Indeed, the brain gradually accommodates itself to the compression, originally caused by depressed bone. In children, owing to the soft resilient character of the cranial bones, what was originally a deep depression often disappears, or at least the depressed surface so nearly regains its natural level as not to cause any inconvenience, and scarcely to be perceptible to the touch. The correct diagnosis of simple fractures of the cranial bones is most important, as the extravasation into or under the scalp tissue, which has already been spoken of, might mislead the surgeon to suppose there was depressed fracture when no such lesion existed, and so lead to dangerous practice.

Compound and compound comminuted fracture may be considered under the same head, as differing only in degree, for all cranial fractures, except simple fissures, are more or less comminuted. In compound fractures the wound of the scalp enables us to see and feel the extent and nature of the fracture, and to judge of the amount of the depression, and the probability of the existence of depressed sharp projecting points of bone or

loose fragments of the skull, and so guides us as to the treatment necessary. When the scalp wound is too small to enable us to examine the full extent of the fracture, it can be enlarged sufficiently for that purpose. In some cases, however, the external appearance of the bone might mislead, as, for example, when the injury has been inflicted with a sharp-edged missile, such as a quoit thrown with great force, the edges of the wound in the bone look comparatively smooth, and not much depressed, when in reality a narrow portion is driven in and impacted, and the internal table extensively broken up; and I have seen the same thing occur from the kick of a horse. In all cases, besides the appearance of the fracture, we must take into account the nature and degree of the force causing the injury.*

Punctured fractures are those in which the injury is inflicted by the patient falling from a height on some sharp-pointed body, as an angular piece of stone or the spike of a rail, or when the patient is forcibly struck on the cranium by some sharp-pointed body, as, for example, by a sharp fragment of rock projected by the explosion of a shot in mining, or by a pitch-fork falling from the top of a hay-rick, or similar causes. In such cases the accident looks trivial, as there is only a small scalp-wound, and a mere punctured depression or small hole seen in the outer table of the skull, and the patient suffers little or nothing at first; there is seldom even slight concussion. The inner or vitreous table of the skull, however, suffers in general to a much greater extent. It is either projected inwards in an angular



Fig. 4.

manner on the dura mater, or extensively comminuted in a star-like or radiating manner, numerous loose detached portions lying between the bone and dura mater, which is separated more or less extensively by the projecting force. Hence the term stellate or

radiating fracture is sometimes used to denote this form of punctured fracture (Fig. 4).

* See Clinical Cases.

The usual explanation of these effects of a punctured fracture of the cranium is, that whilst the outer fibrous and more resisting table of the skull is merely perforated, the extremely brittle, internal, or vitreous table is largely comminuted and projected inwards. The brittle character of the vitreous table no doubt explains to a certain extent the amount of comminution, but the real explanation of the effect produced is to be found in the direction of the force. Here, as in a bullet-wound, the point of entrance is small, the point of exit large, and the inner table driven aside in fragments. Any one may satisfy himself of this by inflicting forcibly on the dead subject a punctured fracture from the interior of the skull outwards, when it will be found that the outer table will be projected outwards, though perhaps not comminuted to the same extent as the vitreous table, when the punctured fracture is caused in the usual way, because in the latter both the direction of the force and the brittle texture of the internal table combine to produce great comminution. Suicidal gunshot wounds inflicted with a small pistol-ball, fired from within the mouth, cause large comminution and eversion of the outer table of the skull, when the ball perforates the cranium, showing the effects of the direction of the force causing the fracture. It is most essential to bear in mind the condition of the bone in punctured fracture in relation to the brain and its membranes, so as to understand the reasons which induce us to interfere at once in such fractures, although no bad symptoms may be present. In these cases it is indeed rare to have any untoward symptoms until six, eight, or ten days after the injury, when the usual symptoms—meningitis and intracranial suppuration—begin to manifest themselves.

Fracture of one of the tables of the skull may occur, but such injuries are rare. I have never in my own practice met with such an injury, and I should think it must almost be limited to the frontal bone, in which the divergence of the tables at the frontal sinuses might admit of the one yielding alone without implicating the other. Thus a direct blow might break the outer table over the frontal sinus, and the

inner not yield to the force ; or, in a fall on the occiput, the effect of the 'contre-coup' might split or fissure the inner table at the frontal sinus, without similarly affecting the outer table. In the case of the more serious lesion, fracture and probable comminution of the internal table alone—in which, as in punctured fracture, it would be proper to interfere if we could determine the existence and site of the fracture—I can scarcely conceive of any diagnostic symptom to warrant interference until those of intracranial suppuration begin to manifest themselves, and then the chances of successful interference would be small.

'Ecrasement,' or smash of the cranial bones, is usually the result of great force ; as when a person falls from a great height, or when a heavy weight or force crushes the skull, or as the result of a gunshot wound, as when a heavy charge of small shot strikes the vault of the cranium obliquely. In such cases, as may be readily conceived, the injury is almost immediately fatal. But there are degrees in this, as in every form of injury, and even most unlikely cases recover, as that of the girl J. S—r, which will be found in the Clinical Cases ; so that we must never despair, even under unfavourable circumstances, but do what we can to assist the curative powers of nature.

In the *Treatment* of ordinary depressed fracture of the cranial vault, we must keep in mind that the danger depends on the relation of the bone to the brain and its membranes. In simple depressed fracture, even if there be symptoms of compression present at the time, we do not interfere immediately by trephining. We apply cold to the head, give purgatives, and in some cases deplete. If, notwithstanding these measures, the symptoms go on without improvement, then, especially in the adult, it is proper to cut down on the fracture, elevate the depressed bone, and remove any loose fragments which may be present ; but we are not warranted in doing this unless the symptoms of compression do not yield to treatment. In young patients we should be very slow to interfere, as the bones possess great elasticity, and the symptoms of compression may gradually pass off.

In a depressed compound fracture of the skull, in which the

bone is usually much broken up, and portions abruptly depressed, with, perhaps, a point of bone projecting inwards, we ought to lose no time in trephining, although symptoms of compression be slight or altogether wanting. Here we super-add no danger by operating. We are not converting a simple fracture into a compound one, as in the former case, whilst the benefit derived from elevating or removing the depressed portion or removing loose fragments is obvious. When the bone in a compound fracture is fissured, without being much comminuted or depressed, no one would think of trepanning at once, for no bad consequences may result from such a fissure, and the mere co-existence of a wound of the scalp does not greatly increase the danger. But when the fracture is comminuted or depressed, we should operate at once.

From what I have stated regarding the character of the punctured and stellate fracture, I trust you will see the propriety for promptitude in its treatment. You must not be beguiled into false security by the trivial appearance of the injury, or the absence of bad symptoms at the time. Keep in mind the state of the injured bone, and its relation to the brain and dura mater. It must be obvious to you that the projecting points of the table driven in upon the dura mater must irritate, if not lacerate that membrane, or even the brain itself, and that the detached fragments, deprived of their vitality, will act as foreign bodies, which, as they have no means of escape, must necessarily lead to intra-cranial inflammation and suppuration, unless an operation be performed to remove these sources of irritation. This, to be of service, should be done at once. If done early, we remove the fragments and depressed portions of the internal table before they have lacerated or punctured the dura mater, or excited inflammation, and so prevent bad consequences. If we wait till urgent symptoms supervene, our interference is too late, the mischief already done generally proves fatal. Although it is still our duty to give the patient a chance for life, as some few cases have recovered from removal of the fragments of bone, and escape of purulent matter, even when the operation has been

performed late, yet these are rare exceptions, and should not weigh with us as a reason for delay. The operation of trephining should be done at once, and all fragments of bone carefully removed; and when that is done the patients generally make good recoveries, and require little more than cold-water dressings to the wound, low diet, and attention to keep the bowels freely open, and, of course, absolute rest and quiet.

Fractures of the base of the cranium are the cases in which there is the greatest amount of compression and of danger, for, besides the extensive breaking up of the bone and projection of small fragments of it into the most important parts of the brain, there is a great risk of the vessels at the base of the brain being injured. Many, in fact, consider these fractures as fatal in all cases.

The general symptoms of such a fracture are those of compression with bleeding from the nose, mouth, and ear. When there is bleeding from the nostrils, the ethmoid bone is generally broken, and the anterior part of the base of the skull split up. A blow upon the nose with the fist may even cause fracture of

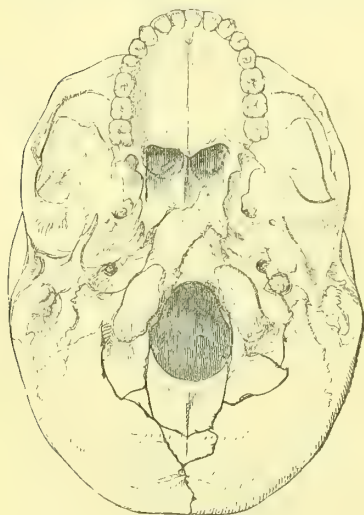


Fig. 5.

the base of the skull, by breaking up the ethmoid, nasal, and turbinated bones. In some cases of fracture of the base of the skull, the bleeding takes place from the ear only, and not from the nose or mouth. It must, however, be remembered, that bleedings from the nose, mouth, or ears, are not absolute diagnostics of this injury, as they may arise from rupture of the lining membranes of these parts in comparatively slight injuries. The force required to cause this

injury is very considerable. In some cases there may be a de-

pressed fracture on the vertex, and along with it extensive fissures passing down towards and causing fracture of the base of the cranium (see woodcut). The accident may occur from a person receiving a heavy blow upon the vertex, or from falling upon the occipital protuberance, fissures extending from the point struck to the base. Or it may occur from the patient falling in the sitting posture ; the head being still in motion is forced against the spinal column which has come to rest, and the base of the cranium is thus broken up extensively. Most generally it occurs from a fall upon the vertex, or from heavy bodies falling upon it. In some cases the symptoms are very intense : if the symptoms of compression do not come on at first, they soon do so ; when they are not very marked at first but become so subsequently, it is probable that effusion of blood has taken place secondarily, and caused the urgent symptoms of compression. These cases, as I have said, are considered by some to be almost uniformly fatal ; but my own experience does not confirm this, for several well-marked cases under my charge have recovered under proper treatment, and it is certainly not right to lay down such an absolute statement as to their fatality, as it might lead to a want of sufficient care in treating them.

The general treatment of fracture of the base of the skull is just that recommended for compression—the application of cold to the head, depletion to prevent further extravasation of blood taking place, absolute rest, and attention to the state of the bowels. By these means the very severe symptoms are often relieved. We can thus do something to prevent further extravasation of blood taking place to any great extent, and it is to that the fatal results are principally due.

It sometimes happens that in depressed fracture of the skull some sharp fragment may wound the longitudinal sinus, or the depression may be so situated that the operation for the elevation or removal of the depressed and comminuted bone may unavoidably implicate the sinus. In either case the complication is a serious one, but it is not now regarded with the dread it once was. Formerly it was supposed that the bleeding would be uncon-

trollable ; but experience has shown that, whilst the bleeding may prove dangerous in some instances, in many it is easily controlled. In my own practice I have met with five cases in which sharp fragments of bone had penetrated the longitudinal sinus ; in two of them the hæmorrhage was profuse and impetuous at first, but was not very difficult to control. One of the patients, a young lad, received a blow on the vertex with a piece of stone which was blown down with great force from the parapet of a high house. The bone was broken in fragments, most of which were loose and easily removed, except one which seemed driven across the line of the sagittal suture. It was impacted, and evidently must have wounded the sinus ; but it was absolutely necessary to remove it. The instant I withdrew the fragment a profuse gush of venous blood poured out from a large wound in the vessel, and the amount lost before I could put my finger on the opening was almost incredible, but the pressure of my finger at once arrested it. On moving the finger to apply a compress of lint, the blood again gushed out, but the lint, supported by a single turn of bandage tied from over the vertex and fastened under the chin, served completely to arrest it, and when the dressing was removed, forty-eight hours afterwards, there was no tendency to bleeding. In another case a man received a blow with a quoit, which struck him about the upper part of the occipital bone, inflicting a transverse wound about an inch and a half long across the line of the longitudinal sinus, near its confluence with the other sinuses. The bone was rather cut than fractured, and a portion of the margin, which had been indented, was drawn out along with the scalp, when I proceeded to examine the wound. On this being done a profuse gush of dark blood followed. I checked it at once with my finger ; but as I considered it necessary to examine the state of the bone in case of fragments of the inner table having been detached, I required to examine with a probe, and during the time I was so engaged, the bleeding was active, though not so violent as at first. Having satisfied myself that there were no loose fragments projected, I placed a compress of lint over the wound, applied ice-bags to the head, and kept the patient in the prone

position for some days, and under strict antiphlogistic treatment. He made a good recovery, and there was no more bleeding. In this case I was apprehensive lest the blood, prevented from escaping externally, might lead to intra-cranial extravasation and compression, and I had the patient carefully watched, determining to trephine in case of these conditions arising, but no occasion for interference occurred. Probably the attachments of the dura mater had not been separated by the force causing the injury. In the other cases the injuries of the sinus were merely punctures, and though the jet of venous blood was forcible, there was nothing like alarming hæmorrhage. In regard to the risk of trepanning over the sinus or close to it, I believe that unless the fractured bone has injured it, if due care be taken in using the trephine, the sinus may escape being wounded. I have twice trephined over the sinus, and in both cases the bone was removed without the upper membrane closing the sinus being opened. In cases where there are sharp shelving points of the internal table of the skull, the movement of the trephine in working it may cause injury to the sinus.

Although this complication is neither so much dreaded as formerly, nor should prevent the surgeon interfering in cases requiring operation for removal of fragments of bone, which must, if left, prove dangerous, still, as I have said, it is a serious complication, and apart from the risk of hæmorrhage, may lead to fatal phlebitis. In the case of the lad I have mentioned, who had fracture of the vertex, the head symptoms were mixed up with those of phlebitis, and when examined after death, the large sinuses presented fibrinous clots and broken down unhealthy matter exactly similar to what I found in a case in which I required to tie the internal jugular vein in a suicidal wound high in the neck, where the patient died undoubtedly from phlebitic pyæmia, so that the more prominent danger—hæmorrhage—is not the only or even the greatest risk of this complication.

LECTURE XCIV.

Hernia Cerebri : its Nature, Causes, and Treatment—The Operation of Trepan : Instruments required for, and Mode of performing it ; how modified by the Nature of the Injury—General After-treatment—Brief Statement of the Cases where Trepan should be performed.

FUNGUS, or HERNIA CEREBRI, is the term used to denote the fungoid protrusion which occasionally follows an aperture in the cranial vault, whether the opening has resulted from an operation such as trepan, or removing loose portions of fractured bone, or has arisen from disease leading to death and exfoliation of the bone. If, as sometimes happens in the case of injuries, the dura mater or the brain itself has been lacerated by the fractured bone, so soon as the bone is removed the pulsatory motion of the brain tends to project the brain substance through the lacerated membrane, and the aperture in the bone. In cases where the dura mater is entire, or merely punctured, the protrusion occurs more slowly. The membrane is projected against the sharp edges of the trephine wound, or the irregular margins left after removal of some loose fragments of fractured bone. This gives rise to irritation, interrupted circulation, and at last sloughing, of the dura mater, corresponding to the part whence the natural osseous support has been removed ; and then projection of the cerebral fungus gradually takes place. In some instances, as I have seen in gunshot fracture of the parietal bone, the dura mater, though not lacerated or wounded, has its vitality affected by the injury, and presents an opaque leathery appearance when the fragments of bone are removed ; the sloughing of the membrane takes place very rapidly, and a large though not very prominent fungus protrudes. (See Plate xliii. Figs. 2 and 3.) I believe, however, that in most, if not in all cases of fungus cerebri, there are other causes in operation besides those men-

tioned, and that laceration, extravasation, and most frequently unhealthy suppuration in the brain-substance underlying the protrusion, will be found present. These last-mentioned conditions were long ago pointed out by Abernethy and others, and Mr. Hill, in his *Surgical Cases*, details a case in which the fungus was accompanied by, and apparently depended on, abscess in the brain, and where, to relieve the symptoms, he was obliged to plunge an abscess-lancet into the brain to evacuate pus, and from time to time to shave off the fungus as it rose above the surface of the bone, and the patient ultimately recovered. My own experience is in accordance with this. In all the cases I have had an opportunity of examining, I have found a cavity in the softened brain-substance corresponding to the base of the protrusion, containing broken down disorganised clots and pus. I think it most probable that the extravasation at first, and subsequently the purulent collection, have been active agencies in causing the protrusion, by expanding the superjacent brain. As to the character of the protruded mass, I believe it varies in different cases. In all there will be found cerebral matter, but it varies in amount. In some, as those in which the dura mater has been torn, and the brain rapidly projected, the greatest part of the original protrusion consists of the cerebral substance, whilst in some, where the growth is more slow, and preceded by inflammation and ulceration of the dura mater, a very considerable part of the fungus may consist of fibrous structure, plastic lymph, and blood, with a smaller proportion of brain.

The state of a patient affected with fungus cerebri is always one of great danger; indeed recoveries are exceptional. Out of several cases in my own practice I have only met with one where the patient survived. In many cases the symptoms are not of a kind to excite alarm at first, but gradually, irritability and excitement come on, with rigors, and then the patient becomes convulsed or paralysed, at last semi-comatose, and continues in that state till he dies. In cases where it follows severe injury, as in the case of gunshot wound, from which the

sketch in Plate xliii. was taken, the patient, though he lives for a fortnight or longer, may never recover consciousness, and the fungoid protrusion apparently causes no alteration in his condition in any respect. In other cases the coma may become profound, and be accompanied by subsultus tendinum or convulsions and hemiplegia.

The method of treatment very generally adopted and recommended is the local application of pressure to repress the fungus, and general antiphlogistic regimen, and occasional anodynes, if there be much excitement. In the early part of my practice I gave this plan a fair trial, but I must say that I never saw it afford relief, and very generally it seemed to aggravate the symptoms, so that even the use of slight pressure could not be persisted in. I accordingly gave up the application of pressure in the early stage, and founding my practice upon the pathological conditions which I found in cases I had examined, and confirmed in my opinions by the views of Abernethy and the experience of Dr. Hill and others, I had recourse to shaving off the fungus even below the level of the opening in the bone, which I was enabled to do, as the cases I had to deal with were openings caused by comminuted fracture, largely exposing the dura mater. In two or three cases distinct, though only temporary, benefit was afforded by the escape of pus and grumous blood, and the fungus was scarcely reproduced. In other cases the symptoms of coma were relieved, and the tendency to protrusion gradually lessened, though no matter seemed to escape; and I never have had any trouble from hæmorrhage or cerebral symptoms from cutting off the protrusion. After a time I use a thin fold of lint soaked with lime-water, or weak solution of tannin, and supported by a bandage or adhesive plaster, as a local application. Attention requires to be paid to diet; and although, as a general rule, antiphlogistic regimen is required at first, and stimulants avoided for fear of exciting the circulation, yet after a time this must not be carried too far; and in many instances I have seen temporary benefit derived from the use of quinine and a rather liberal diet, when the patient perspires much and

begins to be exhausted. After all, however, the very nature of the case gives but small chance of ultimate recovery. Here, as in many other diseases, our chance of success lies in prevention.

In cases of fracture in which portions of bone have been removed, or in cases where the operation of trephining has been performed, I have long been in the habit of using a modification of the repressive treatment advised by Sir Charles Bell. His plan, as applied to the trepan opening, was to fold a piece of lint several times, and mark it with the crown of the trephine with which the opening had been made. The lint was then cut to the shape and size of the circle, and the compress, so prepared was placed over and within the opening of the bone, and retained by a bandage, the object being to prevent the dura mater from being bulged into the aperture. Such a compress, however, gave rise to great irritation from direct pressure, and was unnecessarily powerful. After trephining, or removing fragments of fractured bone, the head having been previously shaved, I lay down the scalp close to the opening; and over the scalp and aperture I lay a portion of thin gutta percha tissue. Over this I place a flat piece of sponge, larger than the opening, wrung out of water, covering it with a layer of gutta percha; the edges of the upper and under layers of the gutta percha beyond the sponge are touched with chloroform, which makes them adhere, and then this light elastic compress is secured by a bandage or broad strip of adhesive plaster. This local treatment I have found most useful, as at once a clean and simple dressing, and as tending to repress the bulging upwards of the brain and dura mater against the margins of the aperture in the cranium. It should be combined with strict antiphlogistic treatment, purgation, and non-stimulating diet at first.

The operation of TREPAN or TREPHINING, strictly speaking, means the perforation of the cranium with the special instruments, the trepan or trephine; but the term, Operation of Trepan, is now very generally used to denote all operations on the cranium having for their object its perforation—the elevation of

depressed, or the removal of comminuted fragments of bone, whether performed with the trepan or other instruments.

The instruments required for the operation are not very numerous. The old trepan and trephining cases used to contain a great array of instruments, many of which are now never used: such were the rasparatory, for scraping off the pericranium; the perforator, for boring a hole to insert the centre-pin of the trephine and the lenticular. The last-mentioned instrument, however, may occasionally be useful; at least I can conceive a case where it might smooth off an irregular edge, but I have never used it myself. Certainly it should not be used in every case to smooth the edge of the trephine wound, as used to be done, as that is likely to do harm by unnecessarily separating the dura mater by the button at the end of the instrument. The instruments really necessary are—the trephines of different sizes, so arranged that they can be fitted to the handle of the trepan or trephine as required; trephine forceps fitted for removing the circle of bone cut by the trephine; an elevator; a “Hey’s saw;” bone-pliers; the lenticular; a small brush to clear the teeth of the trephine during the operation; a thin flat probe of wood or quill to examine the depth of different parts of the circle during the operation, and the usual apparatus of bistouries, sharp and probe pointed; dissecting and artery forceps, sponges, lint, etc.

The operation is modified by the nature of the causes requiring its performance, and as the simplest example of trepanning or trephining is perforation of the cranium for the purpose of evacuating blood or purulent matter, I shall first show you the method of procedure in such cases.

The operation consists essentially of three stages:—

1st. The incision of the scalp and pericranium.

2d. Section of the bone with the trepan or trephine.

3d. Evacuation of the extravasated blood or pus. In cases of depressed fracture, the 3d stage consists in elevating the depressed, and removing the loose fragments of bone.

In operating for evacuation of blood or pus, the line of

our incision of the scalp will often be determined for us by some wound in that texture. If, however, there be no wound of the scalp, or only a small one, then, if the evacuation of purulent matter be the object, I make a free crucial incision through the puffy or boggy scalp, so as at once to expose the bone and to allow the unhealthy infiltrated pus to escape from the scalp texture. In the case of operation for extravasated blood, I prefer a V-shaped incision, the apex pointing downwards, as the flap adjusts itself more readily afterwards. In either case, the vessels of the scalp which bleed should be secured before proceeding to the section of the bone. The size of the crown of the trephine, which is to be used for section, should be large, to facilitate the evacuation of the blood or pus. In the case of a fissure of the bone being discovered when we are trephining for extravasated blood, the centre pin of the trephine ought to be inserted close to the fissure, so as to make sure of including the line of the injured vessel, and to be able to secure it if possible after the evacuation of the coagula. When our object is to evacuate purulent matter, the crown of the trephine is placed over the denuded portion of bone, as that is most likely to correspond to the internal collection of pus.

The incision of the scalp having been made, I proceed to clear the bone for the saw; I divide the pericranium crucially, and then push it aside with the handle of the scalpel till I gain sufficient room to apply the trephine. Scraping off the pericranium, as used formerly to be done, is a most mischievous practice. The bone being now prepared for section, I apply the trephine; but you will observe that, before doing so, I project the centre pin, and fix it considerably beyond the line of the edge of the saw. I now press the centre pin firmly into the bone, and begin to work the trephine. When I remove the trephine, and find I have made a sufficiently deep groove to fix the saw, and allow it to work in the circle, I withdraw the centre pin within the crown of the trephine, for, if this were neglected, it would perforate the bone before the circular saw, and so injure the dura mater. After brushing out the detritus of the bone from the

teeth of the saw, I again resume the section of the bone; from time to time removing the trephine to clear its teeth, and also to ascertain the depth of section at different parts of the circle. In operating on the living, you must proceed very deliberately, and that is one reason I prefer the trephine to the trepan, as the ease with which the latter is worked is very apt to make the operator careless and lead to accidents. You will notice that I am now sawing with only one-half of the circle of the trephine, and using the instrument unevenly as it were. The reason is, that I found with the quill probe that my section was much deeper at the upper segment of the circle than at the lower. The form of the cranium leads to this. Again we must keep in mind the unequal thickness and hardness of the cranial bones, and carefully examine the section every now and then, and accommodate the pressure on the saw accordingly, elevating the teeth of the saw from that part of the circle where the section is deepest, and working more on those parts where the section is shallow. I now feel that the section is almost complete, and that if I used the trepan forceps or elevator I might remove it with a very little force, but that would leave an irregular margin, and might lead to irritation of the dura mater, so I continue to use the saw very lightly at the undivided part of the circle till I feel the bone loose, and then with the forceps I simply lift out the circle of bone. On the living, the blood or pus, if present between the bone and dura mater, would now be exposed, and the evacuation being effected, the scalp wound is closed, and dressed as I have recommended when speaking of fungus cerebri, or simply with tepid water lint laid over the part.

When the operation is required in cases of fracture of the cranium, our operative procedure is modified by the nature of the injury. In many cases the use of the trephine is not required. In largely comminuted fractures, for example, by getting out one fragment with the dissecting forceps, or raising an edge with the elevator, we gain room to elevate or extract other fragments. In other cases, by using the Hey's saw to cut across the base of some angular portion of the bone, which is sharply de-

Fig 6



Fig 4



Fig 7



Fig 1



Fig 8

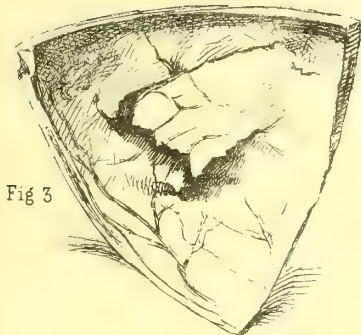


Fig 3

Fig 10

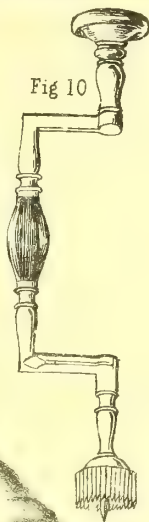


Fig 2

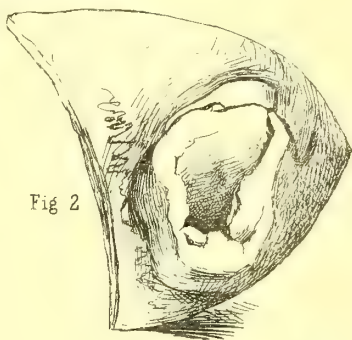


Fig 5

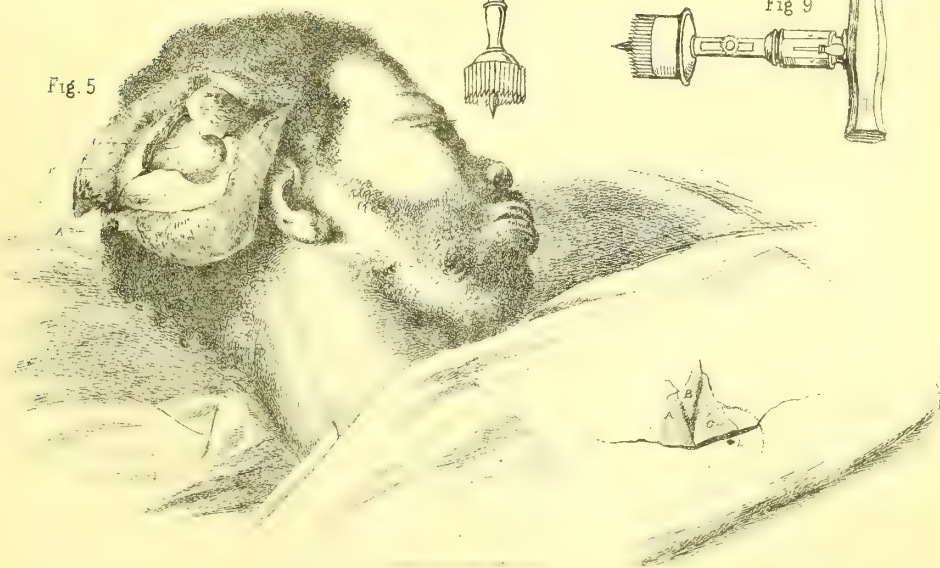
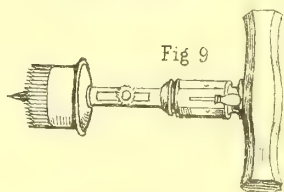


Fig 9



pressed, we are able to remove it and thus gain room to enable us to deal with the other portions, as on examination may seem best (see Plate xlv. Figs. 2, 3, and 4). When we require to use the trephine in fracture of the skull, whilst the general principles regarding its use are the same as I have already described when operating for evacuating for blood or pus, yet there are important modifications in its application which we must attend to. In cases of depressed fracture, it is usually recommended to place the crown of the trephine on the sound bone, close to the depressed edge, as represented in the accompanying woodcut, so as to get the elevator introduced below the depressed edge, to raise it, using the sound unfissured margin of the trephine wound as the fulcrum for the lever. If the object in view in such cases was always and only elevation of the depressed edge, the principle would be correct enough ; although even then we would frequently find, that, owing to the depressed edge carrying along with it a shelving portion of the internal table from the undepressed part of the bone on which the trephine had been placed, we might not be able to introduce or use the elevator without a further section being made.

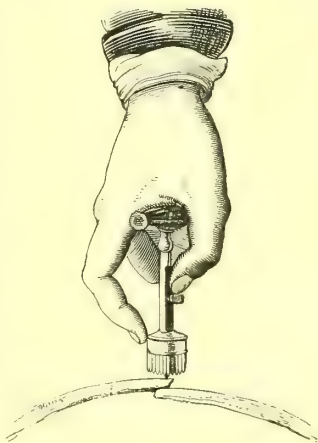


Fig. 6.

My own experience in a very considerable number of cases in which I have operated, and others where I have assisted in operations for depressed and comminuted fractures of the skull, enables me to state that the removal of detached and depressed portions of bone is much more generally necessitated than mere elevation of the depressed margin, and hence our application of the trephine should be arranged so as to enable us to effect both objects with as little removal of sound bone as possible. In many instances we can effect this, as I shall show you, without using the trephine at all ; but supposing

that, as often happens, we must use the trephine to get sufficient room, then attention to the usual conditions of fractures requiring trepan, will, I think, indicate that the instrument may be applied with greater advantage at a different point from that usually advised. In almost every case in which there is a deep and abruptly depressed point or margin of the fractured cranium, it will be found that the bone is fissured across the base of the depressed fragment. At the fissured part there is no shelving of the inner table, the bone is more or less completely cracked through in an even line ; beyond the fissure the bone is perfectly sound and resistant. If the trephine be applied there, so as partly to overlap the fissured part, the sharp depressed fragment, with the shelving portion of the internal table, will be easily withdrawn, and other loose fragments removed, and any remaining depressed margins of the undetached parts of the bone can be as easily elevated. I have said, that in many cases of comminuted fracture we do not require to remove a circle of bone with the trephine, but can effect our purpose without sacrificing any sound bone. I will show you what I mean by operating on this comminuted fracture made on the subject, which enables me to exemplify exactly what would be required in such an injury in the living. You notice the fracture is comminuted and depressed, but that fragments are closely impacted. I choose this large triangular fragment, knowing that its removal will give me room, either to elevate the other depressed portions, or that, on its removal, these will be found loose, and be readily picked out. I now apply the cranial saw, known as Hey's saw, and with it, as you see, I saw across the base of the triangular piece of bone ; next, with the dissecting forceps, or the thin point of the lever, I loosen it at the base, sides, and apex, and carefully remove it. This, you see, is a slow process, but now you perceive the effect. Most of the other fragments which were wedged in by it are now found to be loose, and I lift them out, elevate readily the other depressed margins, and next examine for and pick out those small scales of the internal table lying on the dura mater ; and all

this is effected without removing any sound bone, and with the least possible disturbance of the parts.*

In trephining, in cases of punctured fracture, in which our chief object is to remove the depressed points and detached fragments of the internal table, corresponding to the puncture and radiating from it in all directions, I use a full-sized trephine, to permit of examination and easy extraction of the spicular portions of bone. To effect these objects, the puncture in the outer table of the skull should be the centre of the circle of bone to be removed. The objection to this, however, is, that to insert the centre pin of the trephine there would be very dangerous, but it is not necessary to use the centre pin. I take a piece of thin wood or moderately thick pasteboard or leather, and cut out a circular opening in it with the trephine I am about to use, and smooth the edges of the opening so made. I now place this over the part of the bone to be removed, the punctured wound of the bone being in the centre. The pasteboard is held firmly by an assistant until the trephine has made a sufficiently deep groove to work steadily in, and the section of the bone is then proceeded with as already described. In all cases of depressed fracture, but more especially in this form of injury, the trephine should be worked steadily and gently without jerking, as otherwise any unsteady movement might cause the shelving portions of the internal table to impinge upon and puncture the dura mater and even the brain itself. When the section is completed, the fragments—even the smallest—must be carefully picked out, and to make quite sure of removing all, without irritating too much the dura mater, I generally, after extracting the fragments that are visible, take a camel-hair pencil of large size slightly wetted, and introduce it under the margins of the bone, so as to sweep off any scales or debris of bone which may be lodged there.

Finally, in this and all other forms of depressed fracture in which we operate, the state of the dura mater should be examined before closing the wound; and in all such cases the

* See Clinical Cases.

plan of dressing the wound I recommended when speaking of the prevention of fungus cerebri, should be employed at first, and indeed in most cases throughout the cure.

The general after-treatment may be stated as antiphlogistic. Opium or other anodynes may be given to procure rest. At one time opium was considered as improper in head injuries, but if judiciously given, and its effects watched, it is often very beneficial. Ice to the head at first is of great use, both for modifying the circulation and as a sedative. In some, however, its effects are too depressing, and hence its action must be watched. In cases where we operate to evacuate purulent matter, the treatment must be modified in many cases. Nutrient diet and quinine, and even wine are often necessary, and instead of doing harm prove of the greatest benefit. In fine, the state of the individual patient must regulate our practice.

I have already stated, when speaking of the various injuries of the head, the circumstances which may require the surgeon to perform the operation of trephine, and the principles on which he acts in each case. But here, as in some other cases where emergency demands promptitude in action, I think it advisable, before leaving this important subject, to state succinctly, in a dogmatic form, the cases in which I would advise trepan to be performed :—

- 1st. *Without delay*, in all cases of distinct punctured fracture, to avert mischief by removing the fragments of the inner table.
- 2d. In cases of compound comminuted fracture, with depression (not in mere fissure, with wounded scalp).
- 3d. In simple depressed fracture, when, after a fair trial of other measures, the urgent symptoms of compression are persistent.
- 4th. In compression from extravasated blood, when the position of the injury or the existence of a fissured fracture indicate the probability of a large artery, such as the middle meningeal, having been torn.

- 5th. For intracranial suppuration, when the symptoms, and the existence of the puffy swelling or unhealthy state of the scalp-wound and bone give an indication of the probable position of the pus.
- 6th. In certain chronic cases, from disease or alteration in the bone following contusion or other injury causing cerebral symptoms, such as local paralysis or epileptic fits.

This last rule is by no means so imperative as the others.



LECTURE XCV.

Injuries of the Spine : their similarity to those of the Brain—Concussion of the Spine : Objective and Subjective Symptoms which characterise and accompany it ; Indications of Treatment—Fractures and Dislocations of the Spine : their Diagnosis, Prognosis, and Treatment—Tumours of the Scalp : Cystic, Fibro-Plastic, Malignant, Vascular-Erectile ; the Diagnosis and Treatment of each—Cirsoid Aneurism or Arterial Varix—Necrosis of the Cranial Bones.

ALTHOUGH INJURIES OF THE SPINE may not be considered as belonging properly to the region of the head and neck, yet they are so similar in character to those of the head—the important feature being the implication of the nervous centres—that I think these injuries naturally come to be treated of in connection with each other. By doing so we will also save much needless repetition.

Like the brain, the spinal cord may suffer from concussion, without lesion of its substance, and from the effects induced by such injury. From compression caused by intraspinal extravasation, owing to laceration of vessels, in an injury causing concussion or fracture. From effusion, the result of inflammation of the spinal membranes after injury ; or from direct and forcible compression, caused by displacement of the vertebræ in fractures, and dislocations of the spinal column. It is also liable to undergo softening and alteration in structure from inflammatory affections of a chronic type, following slowly on comparatively slight injuries.

The pathological conditions in concussion and compression of the spinal marrow are strictly analogous to those which we traced in these conditions in relation to the brain. The symptoms vary, however, in consequence of the difference in the functions of this part of the cerebro-spinal system, and hence they also differ according as the injury implicates different points of the spinal cord—the general symptoms being those of interrupted nervous power to the parts below the seat of injury.

From the anatomical arrangement of the spinal canal and its contents, the small size, form, and firmer consistence of the medulla spinalis, as compared with the brain, and from the arrangement of its membranes and vessels, especially the large size of the rachidian veins, it must, I think, be obvious, that if the medulla or its membranes suffer any direct lesion, its structure is likely to be implicated to a greater extent, and the bad effects produced are more likely to be permanent, or even progressive, than is the case in head injuries. Even injuries of the interspinous and other ligaments, may, from their close connection with the lining membrane, be followed by chronic affections of the spinal marrow.

CONCUSSION OF THE SPINE may be caused in various ways, as by a person falling in the sitting posture, or backwards and striking the back against some projecting body, or by a person being suddenly and forcibly projected forwards, and then suffering from the violent recoil, as frequently happens in railway accidents. The symptoms produced will be more or less loss of motion, or sensation, or both, in the parts below the injured point. If the concussion be severe, and has affected the spine high up in the cervical region, life may be at once extinguished. More generally, however, the result is loss of power of the extremities and sphincter muscles, together with difficult respiration and priapism.

If the case has been merely one of concussion, the symptoms after some hours begin to pass off and gradually disappear; and if the patient be kept quiet, lying on the side or in the prone position, and cold applied to the spine by means of ice-bags when reaction sets in, no bad consequences may follow, if only the patient be very cautious for a length of time not to exert himself in any way. In other cases, if, after the original symptoms disappear, loss of nervous power again manifests itself, preceded by pain or uneasiness in the back, leeches should be at once applied, and the bleeding promoted by fomenting with sponges wrung out of hot water. Sub-

sequently cold should be applied to the spine as before, and absolute rest and non-stimulating diet strictly enforced. Great attention should be paid to the state of the bowels and urinary bladder.

The relapse of interrupted nervous function shortly after the original symptoms have passed off and reaction has occurred, points to intraspinal extravasation as the cause. If pain and febrile symptoms occur at a later period, followed by the interrupted nervous function, inflammation of the membranes or of the cord itself is indicated. In this case, however, the interruption of the nervous power takes place more gradually than in the former, and is generally preceded by fever, hyperæsthesia, and painful cramps or startings of the limbs. The general constitutional disturbance also is more marked, so that, besides the period of accession, the symptoms of the two conditions of extravasation and inflammation are sufficiently diagnostic. In some instances, concussion of the spine may be followed by chronic forms of diseased action, affecting the medulla spinalis and its membranes, leading to gradually increasing paralytic symptoms. The progress of the alteration is very gradual, and so insidious as not at first to attract much attention; indeed, at first, the symptoms are mainly subjective, and so anomalous as often to be very similar to those of hypochondriasis or hysteria. If, however, any serious change in structure is commencing, certain marked symptoms supervene. The patient complains of a constant feeling of tightness and fulness at the lower part of the abdomen, and of slowness in passing urine. These symptoms he probably attributes to flatulence, which is generally present, and stricture of the urethra. Next, he feels peculiar creeping sensation (formication), pricking and numbness in the extremities. He has cramps and jerking of the limbs when asleep, or about to fall asleep, and in some cases there is hyperæsthesia of the skin, especially in the lower limbs. After a time the patient walks awkwardly, sets down his feet irregularly, and lifts them high from the ground, and unless he is looking at his feet he is apt to stumble, or catch the point of his foot against

slight inequalities. If we examine the patient at this time and desire him to shut his eyes and stand upright, away from any support, he begins to sway, and may even fall or stumble, and pressure on the injured part produces pain and starting of the limbs. After a time the paralytic condition becomes more marked, and the temperature of the affected limb or limbs is below the natural standard of the body. At this time the pulse and general constitution are affected, and the objective as well as subjective symptoms confirm the diagnosis.

I have said that even injury done to the ligamentous textures of the spinal column may be followed by such chronic changes as just described, in consequence of their close relation to and vascular connections with the membranes of the spinal cord, and a good deal has been made of this in regard to railway injuries; but it does not follow that, because it *may* happen *occasionally*, that it *is likely* to happen as a *general rule*. If ordinary care and treatment be adopted, such results will be the rare exceptions, and when the symptoms do arise we can test how far they are really indicative of structural changes or due to an over-excited apprehension, a species of hysteria. We examine the urine whether it be alkaline or contain much phosphatic deposit,—note the temperature of the affected limb or limbs in relation to the natural standard and that of the rest of the body, the movements of the patient, and the state of the muscular tissue as to bulk and contractile power; and thus, by careful personal examination, and using these and other tests, we can form a correct opinion as to the state of the patient in any given case.

I have already indicated the treatment to be adopted in the case of spinal concussion, and that required to obviate the increase of intraspinal extravasation and inflammation following concussion. The slow alterations in structure are not so amenable to treatment, because, from the insidious manner in which they manifest themselves, before the patient becomes alarmed, considerable changes and degeneration in structure have probably taken place. The remedial measures consist of abstraction of blood by means of leeches, or cupping over the part with a view

to relieve local congestion, in cases where the state of the pulse, febrile excitement, and painful jerkings of the limbs are present. In more chronic cases, counter-irritation by blisters, the actual cautery or other form of issue is indicated, and in all cases absolute rest is essential, if possible, in the prone position, or the patient lying on his side rather than on his back. The constitutional treatment must be carried out on general principles, according to the state of the patient, and great attention must be paid to the condition of the urine, as there is always a tendency in it to become alkaline, and easily decomposed. Chronic cystitis is almost uniformly present in the later stages. The condition of the bowels also requires great attention. In some chronic cases I have seen benefit derived from the exhibition of minute doses of strychnine. I generally prescribe it in solution, with the addition of dilute nitric acid, beginning with the $\frac{1}{16}$ th of a grain twice a-day, never exceeding the $\frac{1}{2}$ of a grain, and carefully watching its effects. By this treatment, and the use of the warm or tepid douche, and friction with the hand and hair glove, the patients sometimes recover some amount of power. In some chronic cases marked benefit is derived from the use of baths, such as those of Wilbad, Tœplitz, Gastein or Buxton. But in general these chronic affections, resulting from injury, are not satisfactory in their results.

FRACTURES AND DISLOCATIONS OF THE SPINE are, as you may readily conceive after what I have said regarding concussion, injuries in which the prognosis is always unfavourable, owing to the immediate and direct damage inflicted on the spinal cord by the fractured or displaced bones. Yet we sometimes meet with cases in which there is well-marked displacement or fracture, but where, from the manner in which the symptoms of paralysis pass away whilst the displacement of the bones remains unaltered, it is pretty evident that they were the effects of concussion, and not caused by the direct pressure of the displaced bone. (See case of John S—s in Clinical Cases.) The occasional occurrence of distinct fracture, and displacement of the vertebræ,

with little or only temporary disturbance of the functions of the spinal cord, may be accounted for by the flattened form and small size of the cord in relation to the cavity of the canal in which it lies. As a general rule, however, fracture or dislocation of the vertebræ is attended with complete or almost complete paralysis of the parts supplied by that part of the cord which is below the point of compression. Indeed, in most cases, from the secondary effects of the injury, diseased action, acute or chronic, affects the parts of the cord higher up, and so the loss of nervous power extends until at last complete paralysis takes place. If the injury be high up in the neck, death may result instantaneously, or the patient soon dies from interrupted respiration, depending on paralysis of the phrenic, thoracic, and intercostal nerves, or from the effect of the lesion being propagated to the medulla oblongata. In cases where the injury is lower down, the fatal result is less rapid, and the patient dies, exhausted by low febrile action, cystitis, and bed sores, or from extension upwards of diseased action and degeneration of the medulla spinalis, the paralysis gradually extending, as already mentioned. In some cases, however, when the patient gets over the first effects of the injury, the symptoms improve, and although some deformity remains, he gradually recovers, and the paralytic symptoms disappear. These successful cases should encourage us to use means, and not give up treatment as unavailing.

The *Treatment* to be adopted is similar to that for spinal concussion, only in most cases we require to place the patient on the back, and then the water-couch is almost essential to success. Attempts at reduction of the displaced bones are useless and dangerous, as being more likely to cause further injury to the cord than to replace the bones. Almost all displacements of the vertebræ are attended with fracture, as the short and strong connecting ligaments do not readily permit of luxation, without fracture. It sometimes happens, however, that fracture of the spinous processes and laminae of one or more vertebræ

may occur without displacement of their bodies in consequence of direct injury.

It has been proposed that in fracture or displacement of the vertebræ, giving rise to compression of the spinal cord, we should apply the trephine so as to remove the compressing cause ; but as Mr. Liston has well observed, "the spinal cord is generally displaced and compressed by the lower portion of the fractured body of the bones. One cannot easily comprehend what an operation is to effect in such cases." From my own observation of the state of the spinal marrow in fatal cases, I feel satisfied

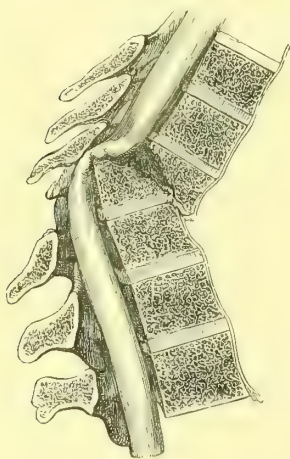


Fig. 7.

that in almost every instance the cord is not merely compressed, but its substance torn through or reduced to a pulp at the point of compression ; and therefore, as its structure and functions are thus destroyed at the moment of the injury, removal of the compressing bone could not restore them. The only case in which the operation of trephining could possibly be of service, would be to elevate the broken fragments in a depressed fracture of the spinous processes and laminæ of the vertebræ. But I would

not expect much benefit from the operation, and would not recommend or perform it. The patient will have a better chance of recovery by the treatment already advised, than if we add a fresh lesion and source of irritation to the existing injury.

Having now discussed the injuries of the scalp and cranium, it remains for me to speak very briefly of the diseases of that region. These are—tumours of the scalp, or those arising from the cranial bones ; cirroid aneurism of the vessels of the scalp ; nævi, or vascular erectile tumours ; and cario-necrosis of the cranium.

TUMOURS OF THE SCALP are generally of the benign class, and the different forms of encysted tumour are by far the most com-

monly met with. The general characters of their growth I have formerly described. In this region they usually exist in numbers, scattered over the head, and varying in bulk from the size of a barley-corn to that of an orange. The cysts are thick and distinct from the scalp-texture, and so loosely connected that they are readily pulled out, unless pressure or wrong treatment has caused inflammatory adhesions between them and the surrounding tissues. If not interfered with, they may attain a large size, but if they inflame and suppurate, or give way, unhealthy action takes place, the scalp becomes thickened and irritable, the cyst of the tumour throws out fungous projections, and exudes a horribly foetid discharge, and the lymphatic glands at the back of the neck and ears become painful and enlarged. Altogether the case assumes an appearance of malignancy, and these cases are frequently spoken of as degeneration of a simple into a malignant growth. There is, however, no true malignancy. The tumour becomes irritable, and degenerates locally, but if the original tumour was a simple encysted one, there will be no constitutional taint, nor any contra-indication to its removal; and so soon as that is done, the enlarged lymphatics will disappear, and the wound heal and leave a healthy cicatrix.

The *Treatment* of encysted tumors in the scalp is in general very simple. If the growth is not larger than a small walnut, we transfix its base with a long narrow bistoury, and cut out, dividing the cyst and scalp, and then seizing the cyst with a pair of dissecting forceps, draw it from its loose cellular connections. In larger cysts, when we require to remove a portion of skin, or when we want to avoid opening the cyst, to prevent its contents getting amongst the hair, we may cut upon the tumour, expose the cyst, and turn it out whole, with very great ease. In cases where the tumour has suppurated, the cyst may be partly adherent, and at other parts very friable, so that we cannot remove it as a whole. Then we remove as much as we can with the dissecting forceps, clear away the contents, and touch any adherent portions with nitrate of silver or other caustic, and apply warm-water dressing. In cases where we have removed the cyst entire in the usual

way, we apply a compress over the part for a few hours, to prevent any blood distending the cavity in which the tumour lay. Afterwards, little or no dressing or other treatment is required. I have said that we usually find a number of encysted tumours existing in different parts of the scalp. In some cases I have removed as many as ten or twelve at once, but I think it better to avoid removing so many at one operation, as a number of small wounds over the scalp may excite undue irritation, and I therefore seldom remove more than four or five of the larger growths at a time.

We sometimes meet with tumours which simulate cysts, but are of a very different nature, soft solid growths, medullary or medullary fibro-plastic. These should be recognised by the rapidity of their development, the general appearance of the patient, and the suspicious circumstance—in this region—that there is only one tumour. The treatment is early excision, before the lymphatics are affected. Some years ago I removed a soft medullary tumour, the size of a small orange, from the scalp of an old woman eighty-five years of age, who insisted on its removal, owing to the pain and rapid growth. Notwithstanding her age, she made a good recovery. I saw her at different times for three years, during which time there was no recurrence of the growth, and so far as I know she may be alive yet.

Occasionally **SOFT MALIGNANT TUMOURS** of the cranial bones involving the scalp occur, and have, in their early stages, been unfortunately mistaken for wens. Operative interference in such cases is most disastrous in its results, for it hastens the progress of the growth, the removal of which is of course impossible. A less dangerous error I have known to be committed, is mistaking the swelling caused by a small eburnated exostosis for a cyst. Such exostoses occur mostly in the frontal region, and between the bony growth and the scalp or skin there is usually a sort of bursal cyst. If this be opened, and attempts made to remove it, a very disagreeable and dangerous form of erysipelas is set up, and this risk to the patient might be avoided by a little care in ex-

mining into the history of the case, and the character of the swelling.

VASCULAR ERECTILE TUMOURS or *nævi* are frequently met with, especially in children, both in the flattened and prominent form. The different methods of treating such growths have been already fully discussed. I may, however, state, that recently I have resorted very generally to galvano-puncture, the continuous current being used, and have found it very effectual, without producing any undue irritation. Whatever procedure is adopted, I would give you this caution, that if the *nævus* be over or close to the fontanelle, we should allow that opening to be closed before resorting to any interference in young infants.

The condition termed CIRROID ANEURISM, or ARTERIAL VARIX, consists in a dilated and tortuous state of the arteries, which form pouches, anastomose with, and lead to enlargement of, the communicating vessels. It is most frequently met with in the lateral regions of the scalp, and over the temples, affecting the branches of the temporal, occipital, or posterior auris arteries, and gives rise to a large pulsating tumour, on which the tortuous trunks of the vessels are seen. Pressure has occasionally been employed with success, to cause obliteration of the vessels. Deligation or compression of the trunks of the temporal or other affected arteries before they enter the tumour, has been the plan hitherto most resorted to. But in some cases of this disease in which galvano-puncture has been methodically applied, the results have been so successful that I think it will probably be found to supersede other measures; or it may be combined with acupressure, to hasten the cure and prevent all risk of embolism from displacement of portions of the clot. In all such cases where galvano-puncture is used, pressure with the finger is maintained on the main trunks during the application, until consolidation of the clot has taken place.

NECROSIS, or CARIO-NECROSIS, with exfoliation of the cranial

bones, has been already treated of as resulting from injury, or caused by specific forms of disease, such as syphilis or struma, or the effects of mercury. I need not therefore enter on the subject here, further than to point out that whilst the general rule in cases of necrosis—viz. to wait for the natural vital separation of exfoliations before attempting their removal—is applicable here as in other situations ; yet, from the proximity of the diseased bone to the membranes of the brain, cases do occur in which, in consequence of cerebral irritation, it becomes necessary to interfere to remove the diseased bone earlier in order to get rid of an obvious source of irritation, and prevent the accumulation of purulent matter. Again, in many cases of cranial exfoliations, it will be found that vital separation has really taken place, but the flattened surfaces adhere, and are retained by atmospheric pressure, and that on elevating one edge, the whole exfoliation comes away with perfect ease. As to other local treatment, it consists in the application of red oxide of mercury, or dilute nitric acid, together with the use of charcoal poultices, to destroy any remaining vitality in the exfoliation, and hasten its separation from the healthier parts, followed by weak solutions of carbolic acid, or of the chlorides of zinc or soda, as lotions to correct the fœtor and promote a gently stimulating effect on the surrounding tissues.

CLINICAL CASES.

CASES ILLUSTRATING INJURIES OF THE SCALP.

1. Anne G——, æt. 48, was knocked down a flight of stairs, whereby the whole frontal bone was laid bare, and the flap, divided into two equal portions, reflected over the face. Silver sutures were used to keep the parts *in situ* after the bleeding vessels were secured. The hair was cut short. Cold applications to head, and the patient kept on low diet. Afterwards, abscesses formed in both eyelids, and bare bone could be felt through the openings which were made to evacuate the pus. The parts, however, cicatrised without any exfoliation taking place, and no other untoward symptom occurred to delay the cure.

2. Henry C—g, æt. 9, fell among some stones from a height of 12 feet, causing a wound near vertex, four inches long. Lips of wound brought together by two silver sutures, hair cut short, and cold to head. Patient was pale, cold, and trembling, on admission, but perfectly conscious. Pulse 80. Next day he became very feverish, complaining of pain in head. Stitches removed, purgatives administered, and two leeches behind ear. Four days after admission, face was slightly erythematous. Cotton wadding applied, with the internal use of Tinct. Mur. Ferri. With rest, low diet, and occasional purgatives, the cure was completed on the twentieth day.

3. David C., admitted 23d December. While in a state of intoxication he fell from the top of a loaded cart, and received a severe wound of the scalp. The incision extended from the left frontal eminence to the middle of the occiput. The scalp was detached from its connections, and turned down over the ear, leaving a considerable surface of bone exposed. A stream of tepid water was directed over the wound, to wash away the mud and filth. The edges were then brought into accurate apposition by silver sutures; the head was shaved, the bowels freely opened, and low diet enforced. Although this patient was an old man and a habitual drunkard, he recovered without an unfavourable symptom.

4. David Williamson, æt. 60, fell from a locomotive thrashing-machine, the wheel of which passed over his head. On admission, twenty-four hours after the accident, the scalp and pericranium were found to be detached from nearly the whole of left side of head, and the bone was extensively fissured. Pulse 74, and of good strength. Head was shaved, poultices applied over the whole of left side, and an enema administered. Slight head symptoms, which yielded to leeches behind the ears and an occasional blister. Two large sequestra separated seven weeks after admission; the wound then rapidly healed, and the patient left, cured.

Commentary.—The foregoing brief notices of the results of different forms of severe scalp wounds are given to illustrate the

principles inculcated in the Lecture on that subject. Success in the treatment of scalp wounds depends greatly on their proper management at first. The wound ought to be carefully cleared of all filth by a stream of tepid water, the hair around it shaved, cold constantly applied to the head, the patient kept quiet in bed, put on low diet, and the bowels freely moved. If the skin has been reflected, it ought to be brought into position by points of silver suture. Sutures have been objected to as tending to produce great irritation, and the objectors either prefer compress and bandage, or leave nature to bring the parts into their proper site. Bad results will not arise from the use of silver, or even of thread sutures, if they are withdrawn on the first signs of irritation; whereas the employment of a compress and bandage implies the collection of the discharge, the frequent change of the dressing, and the infliction of a considerable amount of daily pain and mental excitement. Again, if the scalp is allowed to hang down, it becomes thickened and everted, the process of contraction is tedious, and the uncovered bone is very liable to exfoliate. The cases narrated were treated in accordance with the principles above laid down; and although the wounds were most extensive, the bone laid bare, and extensively fissured in some cases, and though one patient was an old drunkard, they went on most favourably.

CASES ILLUSTRATIVE OF PASSIVE INTRACRANIAL HÆMORRHAGE FOLLOWING CONCUSSION.

1. Mr. R. —, aged 24, fell from the back of a carriage whilst it was in rapid motion. He felt stunned for a few minutes, but recovered, was able to take a glass of water, and thereafter proceeded in the carriage to town. He felt, he said, quite well, but as his head was cut, he requested to be left at a friend's house that night, so as not to alarm his own family, and he walked without any difficulty to the house, some distance from where the carriage stopped. Next morning he awoke with a violent headache, and complained of noise in the head, but after a short time he again felt better. I was asked to see him, and visited him on the third day after the accident. He told me he had another attack of headache, accompanied with the same sensation of a "rushing noise" in the head, as on the morning after the accident. Of the fall, he spoke as having been

slight, and that he never had been unconscious, only stunned. At the time of my visit he felt little or no uneasiness in the head; his pulse (usually 76) was 70, and soft; he had taken some saline medicine, which had acted freely on his bowels, and he made light of his injury. The only disagreeable feeling he now had, he said, was occasional black spots before his eyes, which he attributed to indigestion. I ordered that eight leeches should be applied behind the ears, cold to the head, and enjoined absolute rest. I also prescribed a solution of tartarised antimony (1-16th of a grain) every fourth hour.

Next day he was much better, had had no return of the headache; felt lighter, as he expressed it, and wanted to get up and go home. I, however, persuaded him to remain quiet, and continue the treatment and antiphlogistic regimen; his pulse at this time never rose above 70, and was soft in character. He continued to go on favourably for the next six days, only very desirous to get up and go out. On the sixth day after the accident, as both he and his friends were urgent to have him removed home, I had him carefully removed in a carriage, with as little motion as possible. Notwithstanding every precaution, however, and though the distance he had to be conveyed was not great, violent headache, with the same rushing sensation in the head, occurred during the transit, and continued when he was placed in bed. After he had rested for some time, I felt his pulse, and found it was barely 60 beats per minute, and laboured. I at once ordered twelve leeches to be applied behind the ears, and cold cloths constantly kept to his head, and hot bottles to his feet. Under this treatment the headache and uneasy feeling and noise in the head passed off, and he again felt well. The pulse, however, never rose above 60, and the pupils contracted sluggishly; in other respects, he said he felt quite well, and two days afterwards he was anxious to be up, and could hardly be persuaded to remain in bed. On the eleventh day from the accident, he did not feel so well, complained of aching pain, and return of the sensation of rushing noise in his head. He had a somewhat anxious expression, though, at the period of my visit, the pain in the head had passed off; his pulse had now fallen to 56, and his pupils contracted very sluggishly. In the evening he was flushed and excited, but the pulse was still slow. He passed a very restless night, starting, and speaking through his sleep. He had a dose of henbane, which quieted him and procured him some sleep. Next morning he looked pale and haggard, and though still excited in manner, his pulse was 54 and laboured, his pupils largely dilated and sluggish in contraction when tested by the light of a taper. I ordered a blister to the nape of the neck, and an enema to act on the bowels; and as he was restless, with a tendency to wandering and delirium, he was constantly watched. Throughout the day he was quieter, and said he was free from pain. In the evening, I found him again flushed and excited, and complaining of pain, but his expressions were incoherent. I remained with him for some hours during the first part of the night; about midnight he became delirious and somewhat violent, but recognised me and lay quiet when I spoke to him; by and by he fell asleep, and I left him. All next day he continued in a delirious state, but seemed relieved by the action of the blister. I again watched with him during the evening, and as he seemed quieter and inclined to sleep, I left about midnight. At 4 A.M. I

was summoned to see him. He had awoke about 2 A.M., as from a dream, in a state of violent delirium, and tried to get out of bed, when, in an attempt to do so, he suddenly became convulsed and unconscious. When I reached his house he had so far recovered consciousness, but was incoherent and restless. His features were distorted as from paralysis, and there was strabismus; his pulse was about 50. Cold was applied to the head, and flannels, wrung out of warm water in which mustard had been diffused, were wrapped round his feet and legs. He had passed his fæces and urine involuntarily during the convulsion. After a time he became quieter, but I remained in the house. In the morning he had another slight convulsion, after which he passed into a state of profound coma, with stertorous breathing, dilated pupils, and all the other symptoms of compression of the brain. He died on the morning of the fifteenth day after the accident. The *post-mortem* examination revealed an enormous mass of blood effused over the left hemisphere of the brain, between the bone and dura mater, and also in the occipital region. The greater part of the coagulum was soft and recent, whilst other and smaller portions were of different degrees of solidity, some portions being very firm. The blood seemed to have escaped from the rupture of one of the small petrosal sinuses, where it entered the lateral sinus. There was no laceration or other lesion of the brain-substance, but there was considerable subarachnoid effusion of a plastic character.

2. Mr. —, aged 21. In driving a gig down a steep hill near Edinburgh, the horse ran off, and he was pitched out with great force, and was lifted up quite insensible and cold. He was brought into town, and I saw him on the forenoon of the next day. I was informed that the state of concussion had lasted for some hours, after which he became conscious. He then vomited, and complained of headache. When I visited him, reaction had set in; his skin was warm, his pulse 72, and he had only slight headache. I ordered the head to be shaved over the bruised part, and cold to be applied to the head, and an enema to be given. On my visit in the afternoon, I found that the bowels had acted freely after the enema; but he complained of a dull heavy headache, and a noise "like waves" in the head. On examining the pupils they were dilated, and only contracted very slowly under the stimulus of light. His pulse had fallen to 58 beats in the minute, and his breathing seemed oppressed. I at once bled him from the arm to the extent of 14 ounces. He expressed himself much relieved of the headache, and breathed more easily; and his pulse rose to 76 after the bleeding. I now had the whole head shaved, and iced water cloths constantly applied to his head. I ordered very minute doses of antimony every three hours, and enjoined absolute quietude and low diet. At my visit next day he was somewhat sick from the antimony, but had no headache or uneasiness. His pulse was 70. In the evening he had a slight headache, and his pulse had fallen to 66. I ordered four leeches to be applied behind the ear. In the morning he said the headache had been relieved by the leeches; but that shortly before I came, after getting up to stool, he felt the sounding in the head, and some pain. His pulse at this time was 70. I ordered the cold to the head to be continued, and warned him against getting out of bed on any account. In the afternoon his headache had increased, the pupils were dilated and sluggish, and

his pulse had fallen to 58. I again bled him from the arm to the extent of 10 ounces, and desired the cold and other treatment to be continued. From this time he went on favourably till the fourteenth day, when he had some return of the symptoms. These yielded, however, to the effects of a blister to the nape of the neck, and free purgation; and he left town quite recovered at the end of a month.

CASES OF INTRACRANIAL SUPPURATION.

1. Christina S—n, æt. 36, on the 28th January 1860, was struck on the head by a quantity of hard lime and brick thrown from a house-top, three storeys high. She was rendered insensible for some time, and lost a considerable quantity of blood from a wound, two inches long, situated over the middle of the superior part of os frontis. Admitted, February 7, 1860. Patient staggers as she walks; is dull and listless; complains of severe pain around wound, the edges of which are pale brown and everted; nearly two inches of frontal bone can be felt bare. Has had repeated rigors since third day after the accident; vomits continually; pupils dilated and sluggish; pulse 60. Ordered aperients, and blister behind ear. No improvement following this treatment, Mr. Spence trephined at the seat of the injury. Only a little matter was found; but immediately after the operation the pulse rose to 66, and vomiting only occurred once afterwards, while the rigors never returned. Headache continuing, a seton was introduced; and, on the 25th April 1860, the patient left, cured.

2. James B—r, æt. 28, fell on the 28th April 1860, and was admitted into the hospital 7th May 1860. Over occiput a scalp wound existed, whose edges were swollen, puffy, pale brown, and everted. The bone was entirely denuded of periosteum. He had headache, dimness of vision, and singing noises in the ears. Ordered rest, low diet, purgatives, and leeches. On the 13th an abscess below the wound was opened. On the evening of the 18th he was seized with rigors and vomiting. A blister applied to nape of neck, head to be shaved, and mustard cataplasms to epigastrium. The rigors and vomiting, with high pulse and occipital pain, continued unabated until the 19th, when delirium, and then coma, set in. Patient died on the 22d, at noon. His friends would not allow trephining to be performed.

Post-mortem.—May 24th. Membranes generally adherent. Beneath necrosed occiput a quantity of purulent matter was found. Dura mater at same place sloughy, but entire. From occiput a fissured fracture extended downwards, forwards, and upwards, terminating at the post-clinoid process. No pus was found between the membranes and brain, nor in the brain-substance itself.

Commentary.—The case of Christina S—n illustrates the amount of disturbance which may be caused by a very small amount of purulent matter, and dead or dying bone. Before her admission into hospital, ten days after the injury, she had had

intense headache, want of sleep, vomiting, and repeated rigors, and, for some days before admission, imperfect power of controlling the movements of her limbs. Notwithstanding all remedial measures used after she was received into the hospital, the bad symptoms increased. She screamed with pain ; at the same time a kind of semi-consciousness as to surrounding objects developed itself, and there was limited facial paralysis. The wound of the scalp was unhealthy, and scalp around boggy and swollen, whilst the exposed bone was dry and bare. Under these circumstances trepan was performed ; and although only a very little unhealthy pus was found, yet her recovery went on without interruption from the time of the operation. I cannot help concluding that removal of the dead bone and small quantity of pus, as sources of irritation, and the relief of tension, proved the means of saving this woman's life, judging from the progress of the symptoms prior and subsequent to the operation.

In the case of B—r, though the dangerous symptoms were somewhat slow in manifesting themselves, yet the unhealthy state of the scalp wound, and the denuded bone, in conjunction with headaches, gave rise to an unfavourable prognosis ; and when the more urgent symptoms supervened, combined with the formation of a boggy swelling which, when opened, exposed a farther portion of bare bone, I felt no hesitation in recommending trephining. This, however, was not permitted, and the patient died comatose. From the *post-mortem* appearances, I still think that the operation was advisable, as affording a chance of relief. The existence of the fissure of the base could not be determined during life ; and, moreover, as it was attended with no displacement, and as the only place where the dura mater was diseased was at the point corresponding to the puffy swelling and necrosed bone, I cannot consider such fissure as in itself a contra-indication, especially if we view it in connection with the successful result of some other cases of severe fracture at the base which I have recorded.

CASE OF FRACTURE OF THE CRANIUM.

Arthur McKenzie fell from a ladder whilst at work, and alighted on his head. He was taken up insensible, and immediately brought to the hospital. He was in a state of complete collapse—face pale, extremities cold, pulse scarcely perceptible. A large fluctuating tumour was observed over the left parietal bone, and a sharp raised margin felt at some parts of the circumference of the tumour. Head was shaved, heat applied to the surface of the body, and a little brandy administered. Towards evening the pulse rose to 100, and was stronger; breathing long, loud, but not stertorous; pupils dilated, and insensible to light; patient once or twice spoke, and complained of pain. Six leeches were applied behind the ears, and cold to the head. Under the repeated application of leeches, and the use of free purgation, patient rapidly improved. Ten days after admission, as the pulse again rose, a seton was introduced at nape of neck. The tumour now began to disappear rapidly, and an evaporating lotion was applied. Severity of head symptoms soon abated. At the end of four weeks the depression could scarcely be detected, and at the end of two months the patient was dismissed cured.

CASES OF COMPOUND COMMINUTED FRACTURE OF THE CRANIUM.

1. J. H., plumber, was brought to the Infirmary at 3 P.M., August 1, having a short time before fallen from a considerable height in the National Bank. On admission he was nearly insensible, his skin cold, breathing low, and pulse 70, very feeble. There was a wound two inches long on the back part of the head, towards the left side, communicating with a depressed comminuted fracture of the skull. There was fracture of the right leg and of the middle metacarpal bone of the left hand, and a superficial wound on the left arm. He vomited considerably while being placed in bed. Hot bottles were applied all round his body.

At 4 P.M. Mr. Spence applied the trephine, and removed the depressed portion of bone. It was then observed that the dura matter was injured at one point, and the cerebral matter could be distinctly felt projecting. There was immediate improvement in the patient's condition. He became more sensible; his pulse rose to 80; his breathing became more natural; but his face was noticed to be twisted to the right side. Next day he complained of intense headache; his face was flushed; pulse 90. Six leeches were applied behind the left ear, and they were repeated in the evening, giving great relief.—On the 4th his pulse was still 90; headache present, but not so intense. Leeches were again applied.

On the 7th the wound began to suppurate, the pulse fell to 70, and the headache disappeared. From this time the patient progressed favourably, his cure being retarded by cynanche tonsillaris, from which he suffered severely during the last week of August. He is now quite well.

2. Thomas Porter, æt. 22, was kicked by a horse on the head, and

was immediately brought to the hospital, when there was found to be a scalp wound about half-an-inch in front of the posterior superior angle of the left parietal bone, three quarters of an inch to the left of the longitudinal sinus. On introduction of the finger, a considerable depression of bone was detected, a portion being driven in and impacted. His pulse was of a good strength, and up to that time he had suffered from no head symptoms. He was put under the influence of chloroform, and the operation for trephining resorted to. Several impacted portions of bone were removed; the dura mater was seemingly intact, except at one point. There was considerable venous hæmorrhage, which, however, soon ceased. One or two silver sutures introduced to keep flaps of skin in contact, the head shaved, and cold applied. On the following day his bowels were fully opened by means of jalap and calomel, and he was apparently going on favourably, till the evening of the fifth day, when his pulse rose from 85 to 140, and he began to complain of considerable pain in the head. Six leeches were applied behind the ears, and a saline aperient administered. Following day, feverish symptoms still continuing, a blister was applied to nape of neck. Pupils slightly dilated, but readily contract on application of light. On the seventh day there was a distinct rigor; wound looking healthy. Complained of complete loss of power of the right side on the ninth day. Head symptoms more intense; ordered small doses of calomel: portion of dura mater now began to look sloughy; patient became rapidly worse; pulse ranging from 130 to 140; answered questions incoherently; was very violent at times; breathing stertorous; and died comatose on the thirteenth day.

Post-mortem appearance.—Dura mater sloughy at parts; pus effused over the surface of the brain, and an abscess at base of brain on left side.

3. J. T., while following a runaway horse, received a kick on the forehead. He had been drinking previously to the accident, and when admitted to the hospital, half-an-hour afterwards, was in a somewhat excited state, and his pupils were dilated. There was a compound fracture, with depression a little above the right superciliary ridge. Mr. Spence, being sent for, immediately trephined, and found much splintering of the inner table, with slight abrasion of the dura matter. The head was ordered to be shaved and cold applied, while low diet and perfect quietness were enjoined. For six days after the operation the patient progressed most favourably. The wound looked well; there was no headache or flushing of the face, and his pulse averaged 72. On the 7th day, after a restless night, his pulse rose to 86. He was ordered six leeches behind the ears, antimony in doses of a twentieth of a grain, and a saline aperient. Feverish symptoms continued to increase in severity during the two following days. He complained of intense headache; his pupils were dilated, and there was a wild expression of countenance, with slight delirium. On the tenth day, the pulse fell to 40, and, after several violent convulsive seizures, he died comatose. After death there was found to be pus infiltrated into the meshes of the pia mater all over the surface of the brain.

4. A—P—, aged 17, residing at Walltower, near Penicuik. Whilst engaged with some of his fellow-workmen at a game of quoits, he stepped forward to mark the position of the quoits, thinking all had been thrown. Just as he was stooping he was struck on the left side of the head; he

felt the blow and was stunned, but not rendered insensible. He was conveyed home, and seen by Dr. Fanchie, who found he had suffered a compound fracture of the cranium. I was sent for, and saw the patient a few hours after the accident. He was then in bed, conscious but restless, moaning, and suffering from pain in the head. His pulse was slow and full, pupils were dilated, but contracted slowly under the stimulus of light. On examination I found a large scalp wound with depressed and somewhat ragged margins: on raising these, and introducing my finger, I felt that the left parietal bone, about two inches above the squamous suture, was fractured, comminuted, and depressed, and a portion driven inwards and downwards under the lower edge of the fracture. I accordingly, after bringing the patient under the influence of chloroform, proceeded to apply the trephine, which enabled me to remove many fragments; but the large shelving portion was so impacted that I removed a projecting corner of bone with Hey's saw to gain room, so as to avoid risk to the dura mater in extracting it. I then lifted it out easily, and also several other smaller portions which were then exposed. The dura mater had been shaken from the bone for some distance, but so far as I could see or feel that membrane seemed to have escaped laceration or puncture. The wound was then dressed, and the patient replaced in bed. From the time of the operation he went on so favourably that I did not require to see him, and he was allowed to go out at the end of six weeks. The operation was performed in September 1868, and when I saw him last, in August 1870, he said he had never suffered any inconvenience, and that he could follow his business, that of a joiner, which requires him to ascend considerable elevations, without any giddiness. The opening left by the injury and trephine wound, which was large, had apparently filled up almost, if not altogether, by a thin firm osseous plate, a result which is unusual in my experience of such cases.

COMPOUND COMMINUTED FRACTURE OF CRANIUM, WITH WOUND OF THE LONGITUDINAL SINUS.

G. B., a young, stout, and healthy cabman, was admitted on the 29th January. When standing on the pavement of the High Street a brick fell from the roof of a house, and inflicted a very severe compound comminuted fracture of the cranium. By the injury he was rendered a little giddy, but not insensible. On admission, the general symptoms were far from being alarming; the pulse was 72, and natural; the pupils equal and contractile; the skin warm; and the respiration normal. The fracture was situated over the posterior extremity of the sagittal suture, and extended about an inch transversely and longitudinally. It was accompanied with marked central depression. There had been a slight amount of hæmorrhage, but it had almost entirely ceased. Chloroform was administered, and the incision in the scalp extended. A small fragment of bone, which was completely detached, was removed, and the bone-pliers were introduced through the opening, so as to divide the denuded and depressed pieces, and allow of their being either elevated or withdrawn. The inner plate was found to have been splintered. The smaller frag-

ments were easily taken away ; but one large, shelving portion had to be divided by the pliers previous to removal. As this latter spicula had been driven into the longitudinal sinus, a gush of blood followed its withdrawal. The jet was easily checked by the pressure of a finger until the wound was thoroughly searched, and all loose particles removed. A small piece of lint was then placed directly over the wound in the sinus, and above it larger pieces, until the whole space was lightly filled. This sufficed to check the hæmorrhage. The patient was replaced in bed, and iced water kept constantly applied to the head. Next day all the pads were removed except the one in direct contact with the blood-vessel. In the evening a saline purge was given ; and as the pulse had risen from 84 to 100, he was put on small doses of tartar-emetic. On the third day a small fragment of bone, which pressed directly inwards on the brain, was removed by the pliers. During the third and fourth days, the pulse varied from 80 to 88 ; the mental faculties were unaffected ; and the general appearance of the patient augured well. On the sixth day, however, he had slight rigors, and the pulse rose to 112. Leeches were placed behind the ears ; and on the seventh day the pulse numbered 92. In consequence of the pulse rising to 100 towards evening, a blister was applied between the shoulders. On the morning of the eighth day he wandered, the rigors and sweats were repeated ; in the afternoon he became comatose, with paralysis of the left arm and leg, and marked dilatation of the pupils. The coma gradually deepened, and he died on the evening of the ninth day after receipt of the injury. On examination, the bone around the wound was smooth and healthy, but underneath the dura mater a diffuse collection of pus covered the right side and base of the brain. A small abscess was found in the posterior lobe. The longitudinal sinus was completely occluded by a large fibrinous clot.

GUNSHOT FRACTURE OF CRANIUM.

A. B., æt. 21, was brought to the hospital on October 2d, at 9.30 P.M., with a severe compound comminuted fracture of the skull, which had been caused by the discharge of a fowling-piece. The fracture involved the left parietal and frontal bones, and was situated about midway between the anterior termination of the sagittal suture and the anterior inferior angle of the parietal bone. The wound of the integuments was much lacerated, and several pieces of the splintered bone were depressed. Mr. Spence, who was at once summoned to the case, removed in all fifteen detached fragments of bone, and elevated any remaining portions which were depressed. The dura mater was found intact, except at one point where there was a small laceration. The patient, who was now placed in bed, after having had his head shaved and cold applied, seemed to be in some degree conscious of what was going on, and to understand questions addressed to him, though unable to answer them. The pulse, which, though weak, was about the natural standard after the operation, about three o'clock next morning became strong and full, and rose to 88 ; and as the patient was feverish and restless, he was ordered antimony in doses of a twentieth of a grain. During the day he vomited twice ; the pulse

varied from 80 to 54. He was ordered six leeches behind the left ear, and an enema, which moved his bowels freely. On the morning of the 4th, after a tolerably quiet night, the wound was looking well, but the pulse, which was about 66, was irregular, and there was slight paralysis of the right side. On the evening of the 5th, six leeches were again ordered to be applied to the mastoid region, in consequence of the pulse having fallen to about 50. 6th.—Pulse 60; urine, hitherto passed in bed, drawn off by a catheter; ordered a castor-oil enema. 7th.—Patient has passed a good night, and seems more intelligent, but is still unable to make water. Convulsions, however, came on in the afternoon, chiefly affecting the paralysed side, and there was considerable hæmorrhage from the wound, through which the brain-substance had begun to protrude. 8th.—Has had two more convulsive seizures; pulse 67, regular; blister ordered to the nape of the neck. About 3 P.M. there was renewed hæmorrhage from the wound, which was arrested by transfixing the bleeding point and securing it by a ligature; pulse 86, regular, but weak and compressible. 9th.—Hæmorrhage again occurred, and could not be staunched till a slough had been removed. 12th.—For the last two days the fungus cerebri has been rapidly increasing, and is now about the size of the closed fist. Patient somewhat restless, but intelligence still improving; has passed water voluntarily for the last three days; pulse 100. 15th.—Since last report the patient has been progressing favourably, but to-day he has had repeated rigors, and been very restless and noisy. Part of the fungus has separated; the bowels have been freely moved by an enema; pulse 106. 16th.—Patient looks much worse; has passed a very bad night. Recurring hæmorrhage from the surface of the fungus, and edges of the wound, arrested by matico; pulse 100. Early next morning symptoms of coma gradually set in, and patient died about 4 A.M. On post-mortem examination, an abscess was found diffused through the left cerebral hemisphere, the surface of which was covered with a layer of pus most distinct towards the base.

Remarks.—The case of Arthur M'Kenzie was one of simple fracture of the cranium, with depression; but the dangerous symptoms were evidently those of severe concussion, not compression. The depression of the cranium was pretty extensive as to surface, but not in depth; and the state of the pulse, pupils, and breathing, as well as the subsequent progress of the case, showed that the symptoms were not due to the depression of the bone. I think it well to notice this, as there is often a tendency, when such injury exists with symptoms of unconsciousness, to regard the fracture as the cause, and to resort to operative measures to remove the depression. This case, with many similar which I have seen, shows the necessity for carefully examining the general symptoms; and—if they be those of con-

cussion—of refraining from operative interference with the depressed bone, but resorting to other treatment. Indeed, even when the symptoms are those of compression, when the fracture is simple, I consider it the wisest plan not to interfere unless the symptoms do not yield to depletion, purging, and other general remedies ; for, in a great number of cases, such general treatment is successful.

The cases of compound fracture of the skull stand out in strong contrast to the last case, as regards the propriety, or rather the necessity, for operative interference. In cases of compound fractures, especially in such as those detailed, in which the injury has been inflicted by great and direct force, and where, through the wounded scalp, we can see or feel that the bone is depressed and comminuted, there can, in my opinion, be no possible reason for delaying the removal of the shattered fragments, and elevating the larger depressed portions. By operating here we superadd no danger. We do not convert a simple into a compound fracture, whilst we remove the detached spicular fragments, which, if they did not directly puncture the membranes, must ultimately, as foreign or dead portions, infallibly lead to inflammation and suppuration within the cranium. In such cases, to wait for urgent symptoms as our warrant to operate, is to wait till the operation is of little use. It was this conviction, founded on former experience, that led me at once to operate in the cases of Porter and J. T. Unfortunately, a sharp-pointed portion of the depressed bone had injured the dura mater, and this, I doubt not, led to the meningitis which proved fatal ; but the numerous detached fragments removed showed the absolute necessity for interference. The venous bleeding referred to in the report of Porter's case followed the removal of a shelving portion of the inner table which had been driven up towards the sagittal suture ; and I think there could be little doubt that the fragment must have punctured the longitudinal sinus, so that its withdrawal was followed by smart venous hæmorrhage, which, however, was soon stopped by very slight pressure.

The case of A. B. was one of very severe and extensive

compound comminuted gunshot fracture ; and when we consider the lacerated state of the scalp, and the extreme splintering of the skull, there can be little question of the propriety of removing the shattered and isolated fragments of bone. Even in the absence of any marked symptoms of compression, operative interference was not only justifiable but urgently called for, as the presence of broken pieces of bone, severed from all vital connection, would, by their irritation of the membranes and their certain necrosis, have undoubtedly been attended by greater risk to the patient. The paralysis, convulsions, and other nervous symptoms, together with the hernia cerebri which subsequently took place, cannot be considered as having been influenced by the operation, for they were no doubt due to sloughing of the membranes, and to inflammation and suppuration within the cranium, following the laceration of the dura mater and contusion of the brain-substance, which took place at the time of the accident. As in this case, true hernia cerebri seems always to be accompanied by abscess of the cerebral matter, and to be the result of increased volume due to the presence of the products of inflammation. Though there was great danger from the recurring hæmorrhage, death was caused not by the hernia cerebri, but by the morbid processes going on within the cranium, of which the hernia cerebri was the result.

CASES OF SIMPLE FRACTURES OF CRANIUM COMPLICATED WITH ACTIVE INTRACRANIAL HÆMORRHAGE.

1. R. M'D., æt. 40. Admitted February 15th, 1859, about 3 P.M.—Said to have been struck by a poker on the head, and pushed violently down stairs. He was seen by Mr. Dewar on admission, who described the symptoms under which the man laboured as being those of concussion. He was, however, nearly totally insensible ; the pulse quick and small ; the breathing very slow and gentle.

At 5 P.M. the patient was in a state of complete insensibility ; breathing slowly, but calmly, not stertorously ; pulse 68, full ; left pupil much contracted ; right pupil much dilated ; both insensible to light. On the left frontal region, about an inch above the eyebrow, was considerable ecchymosis, and a small punctured wound, into which a probe could be passed down to the pericranium. Over the parietal and part of the occi-

pital region of the left side, there was much ecchymosis of the scalp. About two inches above and behind the left ear, the finger could be placed in what seemed to be a depression of the skull, but no wound existed at this part.

At 8 P.M. his breathing had become somewhat stertorous, with slight puffing of the cheeks. Mr. Spence made a crucial incision at the part where the depression of the skull was supposed to exist; and on passing the finger down, a severe comminuted fracture was found, and a portion of the bone depressed nearly half-an-inch. The trephine was applied, and a full half-circle removed from the edge of the bone. The depressed portion was then elevated, and a triangular piece, which was lying loose, removed. There was little perceptible change made on the patient's appearance by the operation. He remained perfectly comatose; his pupils were widely dilated; his pulse immediately rose to 120; and he vomited slightly. He remained perfectly insensible till half-past 1 A.M. of the following morning, when he died.

Post-mortem examination revealed very extensive fracture of the skull, stretching from the point where the trephine had been applied through the squamous and petrous portions of the temporal bone to the foramen magnum on the right side. The right hemisphere of the brain was entirely covered by a thin layer of blood.

2. D. L., æt. 38, fell, on the 27th July, about 3.30 A.M., from a window into the street, alighting on his head. When admitted, immediately after the accident, he had a flushed face, was noisy, excited, and smelt strongly of spirits, but answered questions quite coherently. There was an extensive bruise over the right temporal region, where the patient complained of pain; there was great swelling and ecchymosis of the eyelids, especially the right. There was no external wound, and no depression of the skull. Slight vomiting, but no signs of compression. Pulse 96, and soft. The head was shaved and cold applied, and a cathartic enema was administered. Towards evening, as he was more restless and excited, and the pulse had risen to above 100, he was ordered to have three leeches behind each ear. About 5 o'clock on the following morning I was summoned to the patient, and found him violently convulsed, with a slow and irregular pulse and dilated pupils. In the intervals of the convulsions he was evidently comatose. I made an incision over the point where the patient had complained of pain, and where there was the greatest amount of extravasation, and, finding a fissure, immediately trephined. The inner table was found splintered at the edges of the fissure; there was some amount of blood between the bone and the dura mater, and the latter was tense and bulging, and, when divided, a considerable quantity of bloody serum escaped. The patient derived no relief from the operation; convulsions recurred in the course of the day; coma gradually became more profound; and he died in the evening at 10.30 P.M.

Remarks.—In the case of R. M'D., the question of operative procedure required to be very carefully considered. When I first saw the patient the symptoms of compression were of the most decided and urgent character; but then, from the effusion

of blood below the scalp, it was by no means easy to ascertain whether the depression felt was really a fracture, or the soft pitting in the centre of the hard clotted blood, while the history of the case, as one of concussion, gradually merging into compression after reaction, seemed to point to extravasated blood as the compressing cause ; and the occasional convulsions and sub-sultus tendinum led me to suspect laceration of the cerebral substance. Still, as I felt pretty sure of the feeling of fracture, I determined to incise the scalp to make quite sure, and if I found one, to operate, as, though the other conditions might be present, still a depressed fracture would of itself be sufficient to cause compression, and its removal would give a chance for life. The incision revealed a largely comminuted and depressed fracture, the chief depression being very deep. Several pieces were removed, and the edges of the bone were elevated ; there was no blood between the bone and dura mater. The result of the *post-mortem* examination proved the existence of the other lesions I had dreaded from the history of the case, and were sufficient to account for the fatal result. Still, the propriety of operating in such a case is obvious, as affording the patient a chance, should the depressed fracture be the principal lesion ; whilst of course we can have no positive certainty as to the existence of other lesions, though we may prognosticate them from the symptoms.

The possibility of serious injury of the head remaining latent for a considerable time is well seen in the case of D. L., who, although he had sustained an extensive fracture of the skull, accompanied by laceration of the brain-substance, showed no marked cerebral symptoms for several hours after the accident. On admission, the patient was apparently suffering from slight concussion, which soon passed off, and no alarming symptoms manifested themselves until the following morning, when he was seized with convulsions and subsequent coma. The development of these symptoms, and the period of their occurrence, pointed to extravasation of blood as their cause ; while the site of the external injury rendered it not improbable that

there was fracture of the skull, with rupture of some of the branches of the middle meningeal artery. The operation, though demanded in the circumstances, was followed by no improvement in the condition of the patient, who gradually died comatose. On post-mortem examination, the fissure was found to extend right across the base of the skull. The base of the brain was also found ruptured at several points, more especially at the line of fracture, and a layer of pus covered its entire surface. The occurrence of a distinct layer of pus over the surface of the brain at so early a period after the accident, is certainly remarkable, and may seem to justify a suspicion of the injury being merely a coincidence occurring in the course of an inflammatory action of the meninges. This, however, is rendered improbable, not only by the history of the case, but also by the facts that the pus was most abundant in the line of fracture and at points corresponding to the rupture of the brain-substance, and that the brain-substance itself at these points was undoubtedly the seat of inflammatory action, as proved by microscopic examination.

OPERATION OF TREPAN.

The following extract from a case narrated by Mr. John Bell affords so good an illustration of what I stated in my Lecture on Trepan as to the advantage of using the Hey's cranial saw in certain circumstances instead of the trephine, that I quote it here. Mr. Bell says—

“I made an incision into the tumour, a long incision, which, directed by what I felt without, uncovered a long fracture, the circumstances of which are represented in this sketch. One great fracture (*a*) running down the forehead, passed into the orbit, and was so very wide that it easily admitted the handle of my scalpel; the other limb of the fracture (*b*) ran round in the direction of the coronal suture; the whole piece and corner marked (*c*) was deeply depressed, and so far locked under the edge (*d*) that it was necessary to make those two perforations, and to cut off a small projecting corner with the finger-saw, before we could think of using the lever. The blood rolled out through the first perforation. The depression of the dura mater by the blood was as great as in the former case; the circle in which, I could with the probe feel it detached, was as wide. The rising of the pulse, which had been oppressed; the

recovery from the stupor ; the granulation of the dura mater, and the closing of the wound ; and the daily issue of clotted blood, make this, in all respects, a just parallel with the case I have just related. The extent of the wound was such, that the boy was not dismissed till the 9th of January, the 7th of September being the day of his fall. But what surprised and gratified me was this,—The piece of bone marked (c), which had been depressed and elevated, actually moved with each pulse of the brain, so loose did it lie upon the dura mater. I feared, when I saw the dura mater through the trepan holes, red and granulating ; when, on the twentieth day from that of the operation, I found also all the exposed parts of the skull covered with a fine and florid pile of granulations, this triangular piece of bone excepted (which continued yellow, quite bare, and still movable) ; that it must become entirely carious, and exfoliate ; and that this, by protracting the cure, or, by its exposing the brain, might bring the boy into new danger : I had this impression on the 30th of November, and marked it in my daily report ; but by the 6th of December the same pile of florid granulations had crept along over the whole surface of this portion of the skull, and by the 14th the whole wound was cicatrised.”

Mr. Bell states that when the triangular depressed portion was elevated after removal of a large portion of sound bone by means of two applications of the trephine and section of the intermediate portion with the small saw, he found it so loose that it rose and fell with every movement of the brain, and that he feared from the appearance that it would exfoliate. In his case it fortunately did not, but the chances were all against it retaining its vitality, and it seems to have retarded the cure. Now, by looking at the sketch in Plate xliv. Fig. 4, you will see that by applying the saw to the fissured base of the loose triangular portion, it could have been withdrawn from under the sound margin at *d*, where the trephine was applied, without any removal of the sound bone, and with the probability of a more rapid cure.

CASES OF FRACTURES OF THE BASE OF CRANIUM.

1. John G—n, æt. 39, while in a state of intoxication, fell down a flight of ten steps. He was quite insensible when admitted ; bleeding from both ears (especially the right) and nostrils ; breathing stertorous and slow. Pulse 60, weak ; pupils contracted and fixed. Cold to head and a dose of croton oil was administered. Next day was semi-conscious, drowsy, and complained of severe headache ; vomited violently. Ordered three leeches behind each ear. On fourth day, pain much less, pupils natural ; quite deaf, and saw double with left eye ; pulse 72. On the

sixth day a blister was applied to nape of neck, with good effects. On the thirteenth day all the above bad symptoms returned, along with facial paralysis on right side; leeches and purgatives ordered. A seton was afterwards introduced, rest and low diet being constantly enjoined; and on the forty-seventh day he left, cured.

2. Jane S—r, aged 4 years, was admitted into the Royal Infirmary during the session 1859-60, in consequence of her head having been crushed under a coping-stone, which fell on her, and which was so heavy that it required two men to lift it from off the child. When brought into the hospital she was quite unconscious, with oppressed pulse and stertorous breathing. There was profuse bleeding from the left ear and from the nostrils. Her eyeballs were protruded in a remarkable manner, and the conjunctivæ were ecchymosed, and the tissues of the orbit seemed distended with extravasated blood.

The only treatment which could be adopted was the external application of cold to the head, sinapisms to the epigastrium, and hot bottles to her feet. The coma was so complete that neither food nor internal medicine could be administered except by enemata. A drop of croton oil in mucilage was placed on the back part of her tongue, to act as a purgative. She remained completely insensible for three days, and then began gradually to regain consciousness, and to be able to take food; after which she rapidly improved, and left the hospital perfectly well on the fifteenth day, and continued to be brought, as an out-patient, at intervals, for some time. No bad after-symptoms supervened.

I merely advert to the successful results of these fractures of the base of the skull, as showing that we should not despair even of such cases; for, by carefully watching symptoms, and applying proper remedial measures, we may assist nature in the curative process. I would specially notice, as an example of this, the case of G—n, in which there was evidence of extensive fracture, with great bleeding from both ears and nose, injury of ethmoid, and subsequent foetid discharge from that region. The most remarkable recovery, however, of fracture of the cranium, was that of the child whose head was fairly crushed by a large coping-stone (so heavy as to require two men to lift it from off the child). When brought into hospital her head seemed flattened; the cranial bones felt loose, as if broken up; and the eyeballs protruded. The child was completely insensible from compression, and remained so for nearly three days. At first, recovery seemed almost impossible; and the treatment was necessarily limited to the application of sinapisms to the epigastrium and feet, cold

cloths to the head, and enemata ; yet, when she once began to rally, she recovered rapidly, and wonderfully little deformity of the head remained. On leaving the hospital she seemed quite lively and intelligent.

CASES OF INJURY OF THE SPINE.—(*From Clinical Reports,
Session 1859-60.*)

1. Patrick B—s, æt. 40, was doubled up and crushed by the weight of a horse falling on him, by which several dorsal vertebræ were fractured. Along with complete paraplegia, a low form of peritonitis set in, and he died on the fourth day.

2. John S—s, æt. 26, a strong muscular man, fell backwards over a rail seven feet high. Complete insensibility immediately followed the accident ; but on admission, an hour afterwards, consciousness was partially restored, with, however, all the symptoms of paraplegia, and involuntary emission of semen, urine, and fæces. A fracture was discovered at the sixth cervical vertebra. The patient was placed in bed, and the head and neck secured to a pillow. He gradually recovered the power of voluntary movement and sensation. On the twenty-fifth day he went out, and, two weeks after, resumed his employment as a brewer.

3. Peter K—r, æt. 38, during the delirium accompanying erysipelas of the head, jumped from the third storey of a house, whereby he sustained a fracture about the middle of the dorsal vertebræ. For the first ten days he had all the symptoms of paraplegia, requiring the constant use of the catheter. Urine phosphatic. Ordered Nitric Acid. As the bowels continued constipated, Ext. Nuc. Vomic., gr. 1, with Ext. Coloc., was administered thrice a-day. On the sixteenth day he passed his water without the use of an instrument. After this his appetite and strength gradually improved, and he only suffered from pain over seat of injury, for which a seton was introduced with benefit. Three months and a half after the accident occurred he walked perfectly, and still continues well.

Remarks.—The fractures of the vertebræ furnish us with two instances of successful results out of the three cases recorded. As a general rule, such success is unusual. The size of the spinal cord, and the nature of the osseous canal through which it passes, render it almost impossible that fracture, attended with any displacement, can occur, without such compression or injury of the cord as must lead, either primarily or secondarily, to interruption of its function, and consequent paralysis of the parts below the injury. Fractures, with displacement, occurring in the cervical region, may, especially from

the vital functions interrupted, be regarded as almost certainly fatal ; yet, in the case of S—, we have an instance of such a lesion, with considerable displacement, terminating successfully. Judging from the train of symptoms observed, although the displacement and crepitus on movement left no doubt as to the nature of the injury, it nevertheless seems pretty clear, that the medulla spinalis must have escaped direct lesion ; for the complete paralysis and other symptoms, at first urgent, gradually passed off, so that after some hours all the formidable symptoms had disappeared, and in a few days the patient felt so little uneasiness or inconvenience, that it was difficult to make him believe the serious nature of his injury, or get him to keep quiet in bed, and avoid moving his head. It is probable, therefore, that the original urgent symptoms were due either to severe concussion of the cord, or perhaps to a certain amount of direct compression without laceration, the compression being relieved when the patient was placed in bed, with the head supported. For my own part, I incline to the former view, and for this, among other reasons, that there never seemed to be any apparent alteration of the displaced bones, the shortening and bulging forward of the front of the neck, and the irregular depression and prominence felt posteriorly, being as marked, after the bad symptoms had passed off, as they were before. The interest of this case, however, does not terminate with the cure of the primary injury, for, contrary to my wish, he left the hospital on the twenty-fifth day after the accident, saying he felt quite well, and would be very careful of himself at home. I subsequently heard he had returned to his work ; and on the 11th of March he applied to be re-admitted, on account of gradually increasing paralysis, which had rather suddenly supervened a few days before. The quick pulse and febrile condition of the patient, together with the difficult respiration and the paralysis affecting parts deriving their nervous supply from above the original seat of injury, led me to infer that secondary changes, the result of irritation and inflammation of the cord and its membranes, were taking place, if, indeed, softening had not actually occurred, and

gave me a most unfavourable opinion of the case. Under treatment, however, the bad symptoms again gradually disappeared, and he was finally dismissed cured.

The case, independent of other points of interest, is instructive, as encouraging to careful treatment even in cases all but hopeless, and as showing the necessity for enforcing absolute and prolonged rest and treatment, although the patient or his friends may consider all danger as past.

LECTURE XCVI.

Injuries of Face—Contusions—Wounds—Wounds implicating the Portio Dura—Wounds implicating the Parotid Duct, and leading to Salivary Fistula—Treatment of Salivary Fistula—Wounds of or near the Orbit—Ectropion—Ptosis—Removal of Eye—Extirpation of the whole Contents of Orbit—Obstruction of Nasal Duct—Fistula Lachrymalis : Bowman's Operation for its Prevention ; old Operation—Fracture of Bones of Nose—Foreign Bodies in Nostril—Epistaxis and its Treatment.

THE INJURIES OF THE FACE most commonly met with are, contusions, wounds, and fractures of the nasal and maxillary bones.

CONTUSIONS OF THE FACE, except when complicated with more serious injuries, seldom come under the care of the surgeon, as every one has some infallible method of cure in which he trusts. Occasionally advice is asked as to the speediest method of getting rid of the disfigurement caused by ecchymosis. If the patient apply immediately after the receipt of the injury, cold, assiduously applied, often prevents and always modifies the extent of the extravasation, and the discoloration arising from it ; but if the ecchymosis has taken place, then I know of nothing likely to be of much use except stimulating evaporating lotions to promote more rapid absorption. Time must do the rest. The aid of the artist is sometimes resorted to, but "the effect" is more remarkable than pleasing.

Owing to the great vitality of the textures, WOUNDS OF THE FACE generally heal by the first intention, unless prevented by some special cause. The direction and position of the wound are important. In cases of accidental wounds, causing injury to nerves or other structures, of course the mischief is done, and we can only, in certain cases, try to remedy it afterwards. But the

surgeon often requires to make wounds in this region in operating, and for their effects he is responsible. In planning his incisions, he must carefully consider the anatomy and functions of the parts which may be affected by his proceedings.

A wound made in certain directions may paralyse one side of the face completely, by dividing the trunk of the portio dura, and then the face is distorted, and the patient loses all expression on the injured side. If a surgeon made such a wound without its being absolutely necessary, he would commit a serious error. Any incision in the cheek should, as far as possible, be made more or less parallel to the main branch of the portio dura, and the trunk should never be cut across if it can possibly be avoided.

The same care must be taken in reference to the duct of the parotid gland ; but, as an accidental wound may implicate the duct, and give rise to SALIVARY FISTULA subsequently, we must consider how we can best prevent that condition taking place, or remedy it if it has occurred. In dealing with a wound of the face crossing the line of the duct, we must remember the anatomy of the parts. The duct runs from the ear across the cheek towards the nose, and opens into the mouth, nearly opposite the second molar tooth of the upper jaw. In a wound in this part, when we see that the duct is either cut or likely to be cut, the best treatment is to complete the incision into the mouth. Wounds which penetrate the cheek into the mouth are very seldom followed by salivary fistula, for the saliva naturally tends to pass into the mouth rather than outwards, and the direction and position of the duct favour this, if the external part of the wound be closed at once. If, however, the mucous membrane be not divided, a salivary fistula is often caused by the attempt to close the external wound over the wounded duct. The best plan, in such a case, is to complete the wound by dividing the mucous membrane, and then to close the external wound very carefully by silver sutures, whilst the internal wound is left open to allow the saliva to pass into the mouth. When a salivary fistula has become established, we

generally find a small opening with callous edges, and a slight trickling of the saliva over the face. This gives rise to a great deal of excoriation of the skin. Digestion also becomes impaired by the loss of the saliva, and the patient may suffer in his general health.

The old operation for parotid fistula was to enlarge the opening and pare off the edges of the fistula, cut into the mouth, and then pass a seton of silk or leaden wire through the opening. One end of the seton was left hanging into the mouth, the other out of the external wound. This was removed after a day or two, and the external wound was closed by harelip suture. The method of operation which I recommend, and which is now usually performed, is to pare the callous edges, by including them in an elliptical incision, and cut through about two-thirds of the thickness of the cheek. The operator then takes two large straight needles, attached to a seton composed either of silk or leaden wire. One needle is passed through the opening parallel to the line of the duct, and the other is passed lower down and more horizontally, leaving a considerable space of the undivided mucous membrane of the cheek between them. Both needles are drawn through into the mouth, so that both ends of the seton hang into it, that the saliva may be guided in that direction. Lastly, the raw edges of the external wound are brought into close contact by silver suture. This operation is more difficult to describe than to perform, but I consider it much more likely to be successful than the old method of treating salivary fistula.

Wounds implicating the parotid gland itself are not liable to be followed by salivary fistula. For a time saliva is discharged from the wound, but as it cicatrises, the textures consolidate, and the wounded part of the gland is obliterated and ceases to secrete. Should the wound be prevented from healing by the oozing of saliva, pressure, or a touch of a heated wire, will be found effectual in promoting the cure.

Wounds of or in the vicinity of the orbit require attention, as they may affect the functions of the eyelids or lachrymal ap-

paratus, or injure the eyeball itself. Thus wounds of the cheek or forehead, with loss of substance, may, by their contraction, lead to eversion of the eyelids—ECTROPION ; or wound over the upper margin of the orbit may, by implicating the levator palpebræ, cause drooping of the upper eyelid—PTOSIS. The former condition may be remedied by removing a portion of the conjunctival surface of the eyelid, so that the contraction following its cicatrisation may counterbalance the external cicatrix ; or other methods may be required, such as dissecting the margins of the contracted wound, and transplanting a flap to fill up the gap, and allow the eyelid to regain its natural position. Ptoxis, arising from division of the levator muscle, is not remediable by surgical interference, but after a time the divided muscle forms adhesions, and sometimes acts to a certain extent in raising the lid. I have seen ptoxis follow contusions and superficial wounds over the upper eyelid, apparently due to some affection of the nerve supplying the muscle. In some of these cases, a long time elapsed before the power was restored. In such circumstances, after a time, blistering over the superciliary ridge, and sprinkling the blistered surface with a minute quantity of strychnia (about the $\frac{1}{12}$ of a grain) every third day, will be found useful in restoring the nervous power.

Wounds injuring the lachrymal sac or ducts, if they be attended to at first, and if the passage for the tears be kept open during the healing process, generally do well enough. If the inner part of the lower eyelid be drawn down during cicatrisation, and the punctum displaced, the tears pass over the cheek. This is remedied by slitting open the orifice of the duct, on its conjunctival side, that the tears may pass into their natural channel.

INJURIES OF THE ORBIT are always attended with danger to the eye, either by directly implicating that organ, or from the inflammation and suppuration which follow, affecting it secondarily. They may also prove fatal in some cases, from the wound penetrating the brain, or leading to inflammation in that direction, hence they require great attention to obviate bad results.

In cases where the eyeball is directly injured, if any foreign body be lodged in the cornea, or sclerotic, it should, if possible, be extracted at once, and then strict antiphlogistic treatment adopted to prevent mischief. In cases of wounds inflicted by gunshot, where pellets have passed deeply into the eyeball and orbit, the organ of vision is destroyed, and the presence of the foreign body may, and generally does, excite so much irritation as to necessitate excision of the eyeball, either alone or with the contents of the orbit, to save the other eye suffering, or diseased action extending back towards the brain. In cases of abscess of the globe of the eye following injury, but in which no foreign body remains, there is no need of excising the eyeball ; all that is requisite is to open or completely remove the cornea, so as to evacuate thoroughly the contents of the globe, and apply poultices or warm-water dressing. This relieves the tension, and when the cure is completed, the stump of the eye left enables the patient to be better fitted with an artificial eye than if the eyeball had been removed.

When REMOVAL OF THE EYE is required, either on account of injury or disease, the nature of the operation will depend on whether we require to remove the eyeball alone, or to extirpate it along with the contents of the orbit. Wherever the injury or disease is limited to the eyeball, excision or enucleation, as it is now termed, is the operation to be performed. It is effected thus :—The patient being under chloroform, and recumbent, the eyelids are separated by an assistant or the wire-spring speculum ; the operator with a pair of forceps and scissors raises and divides the conjunctiva a line or two from the cornea, as in the operation for squint, only the incision is carried round the whole circumference of the cornea. He next divides, one by one, the recti and oblique muscles. By means of a sharp hook fixed in the cornea, the eyeball is drawn forwards, the optic nerve cut, and the operation concluded. A piece of lint is pressed deeply into the wound to control the bleeding of the artery of the retina, the eyelids closed, and a compress secured over them.

The lint is removed from the wound in a few hours after the operation, and cold-water dressing applied.

EXTIRPATION OF THE CONTENTS OF THE ORBIT is a coarser and more bloody operation. The operator begins by dividing the outer canthus of the eyelids to get room for his after-proceedings: he next passes a needle, armed with a strong thread, through the cornea, that the thread may be used to fix and draw forward the eyeball. The eyelids being separated, the surgeon cuts the conjunctiva round the margins of the orbit, passes his knife backwards along the orbital plate of the frontal bone, taking care to keep its point directed downwards, and sweeps the blade of the bistoury rapidly round the orbit, the eye being drawn forward at the same time to put the textures on the stretch. If the optic nerve has been completely divided, the contents of the orbit are at once removed, or a touch of the knife completes the operation. A sponge is thrust into the orbit to control the bleeding until the surgeon is prepared to seize and secure the divided branches of the ophthalmic artery; a dossil of lint will generally require to be placed in the cavity to control venous bleeding or deep oozing from the central artery of the retina in the optic nerve. The eyelids are then closed and secured with compress and bandage, as in the former operation. The compress and the lint in the orbit are removed after some hours, and cold-water dressing applied over the eyelids.

In both these operations an opiate should be given to allay pain, and obtain perfect quiet to prevent bad consequences.

OBSTRUCTION OF THE NASAL DUCT, leading to distension and disease of the lachrymal sac, frequently requires surgical interference, and the kind of interference will depend on the nature of the obstruction, and the stage of the diseased condition we have to treat. The earlier symptoms of this obstruction are the trickling of the tears over the cheek, and dryness of the nostril of the affected side. The flow of tears over the cheek—EPIPHORA, or STILICIDIUM LACHRYMARUM—may have other causes, such as

increased secretion from irritation of the lachrymal apparatus, from obstruction of lachrymal puncta, or ducts, or from the puncta having been displaced, so that the tears are not directed into them. Or these symptoms may depend not on disease of the nasal duct, but be due merely to congestion of the mucous membrane covering the inferior turbinated bone, or the pressure of a nasal polypus obstructing the free passage of the tears at the lower opening of the nasal duct. The surgeon must therefore examine carefully as to the cause of the stillicidium, and treat the case accordingly. If due to over secretion, the treatment is to remove the source of irritation, and use sedative and astringent collyria. If the puncta or lachrymal ducts are obstructed, dilatation of the puncta and canaliculi by means of Anel's probes should be had recourse to. If the lower punctum be everted from the result of injury or disease, the simple operation recommended by Mr. Bowman of introducing a fine grooved director into the duct, and then slitting it up on its conjunctival aspect, so as to restore a direct channel for the tears, will prove effectual. When the obstruction is at the lower opening of the nasal duct, then relieving the congestion, or removal of the polypus, is the evident indication. When, however, there is stricture of the nasal duct, the tears gradually accumulate in and distend the lachrymal sac; irritation of and increased mucous secretion from the lining membrane of the sac takes place, and unless actively and properly treated, inflammation and suppuration follow, and fistula lachrymalis may be the result.

There is little use in such cases to try the introduction of dilating instruments, such as probes from the nostril, and still less in putting off time by fomentations or anodyne lotions applied over the distended sac. It is in this early stage, before suppuration has begun, that Mr. Bowman's operation for, or rather to prevent, fistula lachrymalis is most advantageous. It is performed thus:—The lower punctum is first dilated by Anel's probe, or by the point of a common pin, and then a fine grooved director is passed along the duct into the sac: along the groove of the director the surgeon glides a thin-bladed knife, an ordinary cata-

ract knife for example, and slits open the canal into the sac. This permits him to introduce a silver probe, sufficiently strong, to pass along the nasal duct, and overcome the obstruction. The distended sac is then emptied of its contents, and tepid anodyne lotions applied over the position of the sac for a few hours to allay irritation. In two or three days the probe is passed again, and followed up by a larger one, and thus at intervals gradual dilatation of the duct is effected, and its function restored, without any deformity being left. If, however, suppuration has occurred, with much inflammatory swelling in and over the sac, then Bowman's method will not suffice ; for not only will it not permit free exit for the pus and other inflammatory products, but the gradual dilatation cannot be properly carried out. The suppurating sac should be opened like an ordinary abscess, and its contents freely evacuated, and a probe passed down through the canal. Afterwards, when irritation has ceased, dilatation is carried out, at first from above, but after a time I introduce the probe from below, to permit the opening in the sac to heal.

In cases where the lachrymal sac has been allowed to burst, and no means have been used to clear the nasal duct, the tears pass from the sac through the opening, constituting the condition termed FISTULA LACHRYMALIS ; and for the cure of this a special operation is generally described. The operator makes tense the eyelids, so as to render the tendo oculi distinct, inserts the point of a narrow bistoury below the tendon, directing the edge outwards, and the point backwards and downwards into the nasal duct ; then partially withdraws the knife and passes a probe along the blade, and finally lodges a style in the duct ; and after a few days removes this, and gradually introduces larger styles, till the duct is fully dilated ; then a very fine style with an enamelled head is left in permanently. For my own part, I never could see the necessity for this special operation. The external aperture must communicate with the sac, and all I have ever found necessary has been to dilate the existing aperture, and pass a probe into and along the nasal duct by giving it the proper direction, and then carrying out gradual dilatation.

FRACTURES OF THE BONES OF THE NOSE do not require much notice. The fracture is easily diagnosed, and if seen before much swelling has occurred, we can ascertain if there be deformity, and its nature. In young persons the septum nasi yields laterally along with the nasal bones, and the result is a twisted appearance of the nose. At other times, as from a direct blow, the septum and nasal bones are flattened, and then we have the "Fancy Nose" resulting. In all cases there is more or less epistaxis from rupture or laceration of the lining membrane. When the nature and direction of the deformity are ascertained, we pass a director, or the handle of a penholder, or closed dressing forceps, within the nostril, and model the bones into position, and leave them thus without any interference afterwards. We should not, except in special cases, push lint up the nostril to keep the bones in position, for that is very apt to lead to suppuration and necrosis, especially if it be a compound fracture. These fractures usually unite readily enough, and little or no deformity is left if the treatment be adopted early.

FOREIGN BODIES, such as peas, beads, portions of slate-pencil, or small pebbles, are frequently lodged in the nostrils by children in their play; and when they find that the substance cannot be blown out of the nostril, they or their friends make matters worse by ineffectual attempts to remove the substance. In some cases of older children, the accident is concealed until the irritation of the foreign body has caused inflammation and discharge from the nostril. If the patient be seen before attempts have been made to extract the foreign substance, there is no great difficulty either in ascertaining its position or removing it. But if there has been interference, the foreign body is generally pushed further back or upwards, and its position is hidden by the bleeding which has resulted from such interference. In cases where the substance has been impacted for some time, the inflammatory swelling and the discharge hide it, whilst the extreme tenderness of the inflamed mucous membrane prevents manipulation, except the

patient be put under the influence of chloroform. In uncomplicated cases the foreign body can be easily seen and felt. The patient should be placed opposite a clear light, and his head held firm by an assistant. The surgeon then introduces a strong flat probe, or an ear-scoop lever, over and beyond the foreign body ; but, before attempting to extract it, he should introduce his finger into the mouth to obstruct the posterior nostril, for if the foreign body were dislodged backwards whilst the child is struggling and crying, it might be drawn into the larynx and cause suffocation, or at least necessitate the immediate performance of tracheotomy ; hence I always adopt the precaution I have mentioned. In some cases a pair of polypus forceps may be used to extract foreign bodies of a flattened form ; but the lever-scoop generally answers best. In cases where ineffectual attempts have been previously made, or in which inflammatory swelling is present, the nostril should be gently syringed with tepid water, to remove blood or discharge and allay irritation. Then the patient should be brought under the influence of chloroform, and the extraction effected as already described. Should there be any doubt as to the presence or position of the foreign body, the nasal speculum should be used, after we have washed out the nostril to remove blood or discharge.

EPISTAXIS, or BLEEDING FROM THE NOSE, frequently follows all accidents or operations about the nostrils. The hæmorrhage is often of a serious character, and requires efficient means to arrest it. This form of bleeding also occurs idiopathically in patients in whom there is a tendency to cerebral congestion or disease. When we do not wish to check it very rapidly, the application of cold, or plugging the anterior nostril, may be sufficient to arrest it. This is, however, seldom sufficient, for if the bleeding be at all serious, it will take place by the posterior nares, and the blood will pass into the stomach, giving rise to vomiting, and the patient may suffer from the loss of blood. Hence we generally plug the posterior nares first, and then the anterior, so as to

command the bleeding completely. Various instruments have been invented for the purpose of plugging the nostrils, but an ordinary gum catheter is quite sufficient. The stilette having been withdrawn, the catheter is introduced into the nostril and brought out of the mouth; a plug of lint secured to the centre of a piece of strong cord is then tied on it, and is drawn back into the posterior nostril, and firmly impacted there. Both ends

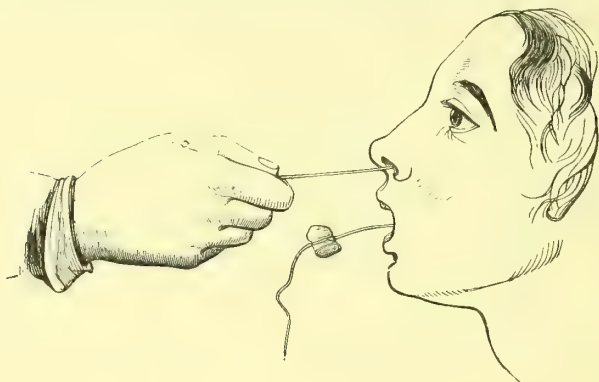


Fig. 8.

of the cord are then tied together loosely at the angle of the mouth. The plug is left in for forty-eight hours or so, and then drawn out from the posterior nostril. I do not approve of using a sponge for plugging the nostril, as it swells from the mucus and blood, becomes slippery, passes out of the posterior nostril, and hangs down the throat; but if a plug of lint be firmly lodged in the nostril, this is not likely to happen.

LECTURE XCVII.

Polypus of the Nostril : Simple ; Fibrous and Malignant ; their Symptoms and Treatment—Ozæna and its Treatment—Ulceration of the Septum Nasi—Rhino-plastic Operations : by Flaps from the Forehead or Cheeks—Liston's Operation for restoring the Columna Nasi—Partial Restoration of the Nose by Flap from the Arm.

SIMPLE POLYPUS OF THE NOSTRIL is a very common affection. I have already spoken of it, as an example of simple vascular sarcoma, when lecturing on tumours. The general symptoms which indicate its presence are a feeling of stuffing of the nose, as if from a cold in the head, and an increased secretion of mucus from the nostrils. As both these symptoms are increased in cold damp weather, the patient for some time attributes his symptoms to a cold ; but as they become persistent, and the difficulty of breathing through the nostrils becomes greater, he examines his nostril, and detects a soft swelling ; or some of his friends observe it. In many cases the bulky mass presses on the margin of the inferior turbinated bone, and obstructs the flow of tears through the nasal duct, and they then flow over the cheek, giving rise to one form of Epiphora. When any of the polypi project towards the pharynx through the posterior nares, the patient feels as if some mucus were adhering to the back of the throat, and is constantly hawking and spitting to get rid of it. When very long and pendulous in this position, the irritation of the fauces sometimes excites vomiting. In many cases the projection of a polypus may so press upon the orifice of the Eustachian tube as to cause deafness. In all cases, as the growths enlarge and fill the nostril, the sense of smell is impaired, and the voice is indistinct and snuffling, and when the patient falls asleep he snores loudly.

In some extreme cases, more especially in cases of fibrous

polypi, great deformity occurs ; the nasal bones and the walls of the antrum yield, and the face assumes the character termed "Frog-face," represented in the woodcut (Fig. 9). In some cases



Fig. 9.

of fibrous polypus, portions of the growth invade the orbit, and evert and protrude the eye, and at the same time distend the antrum and press down the palate so as closely to simulate malignant tumour of the upper jaw.

There are generally several polypi present at the same time in the nostril, and often several small ones are sessile around the roots of the more prominent ones. Hence it is sometimes said that these simple polypi return after removal. This is not the case ; but the small ones constituting the second crop, and which were formerly unnoticed, grow up, and occupy the room

vacated by their more advanced predecessors. It is therefore not a recurrent tumour; but we cannot always be sure of removing every polypus. Their most usual habitat is the mucous surface of the superior and middle turbinated bones. From this position they often hang in clusters down the nostrils. A polypus occupying the anterior nostril, with a long narrow attachment, may slip backwards into the posterior part. We should, therefore, always introduce a finger into the mouth, and feel the posterior nostril, in order to ascertain if there are any polypi there.

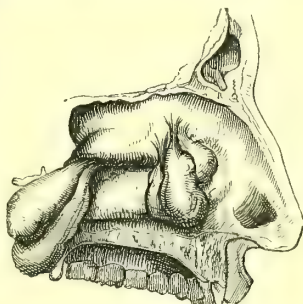


Fig. 10.

The diagnosis of nasal polypus is usually simple enough; at the same time, we must see that it is really a polypus we have to deal with. It often happens that a patient has the ordinary symptoms of polypus, and that the surgeon supposes he sees one when there are none present. The mucous lining over the inferior turbinated bone is often congested and cedematous, and looks exactly like a polypus, and the septum between the nostrils is sometimes placed unevenly, and has the appearance of a polypus. Hence we require to be careful in examining the nostril; but once we have ascertained the presence of such a growth, the treatment is very simple.

To remove these simple polypi, we introduce a pair of polypus forceps into the nostril, by means of which a firm hold is taken of the root of the polypus; which is then wrenched or twisted off from its attachment. This is repeated until all the growths which can be seen or felt are removed.

In some cases, where there are a number of small polypi which are difficult to get hold of, I proceed as if I were going to plug the posterior nares, by using a small plug, and drawing it forwards. By this means I often drag away any small polypi which may be present; and though it looks a harsh proceeding it is not a painful one.

We meet with other kinds of polypi besides the simple ones. We may have a FIBROUS POLYPUS occupying the whole nostril and hanging down the throat. This form of growth is very firm, and is generally attached towards the posterior nares or pharynx. When in that position, we can, by means of a pair of strong toothed forceps, twist them out ; but when otherwise situated, we may have to slit open the nose or perform excision of the upper jaw, as, especially in young subjects, there is a risk of the bones of the base of the cranium yielding if great force be used. In some cases we can snare them in a loop of double-twisted wire, which may then be used as an *écraseur* to separate the polypus gradually, and extract it by the mouth, or we may tighten the wire from time to time till the polypus drops off.

Another form is the MALIGNANT POLYPUS. This is rather a malignant medullary tumour than a polypus, and its character is known by the bleeding from the nostril, the age of the patient, and the nostril becoming rapidly plugged up. We should not remove it, for it would recur again immediately, and the great mass of the growth is deeply situated, springing from the ethmoid cells, so that it would do no good to remove merely the projecting portion. Besides, such operations are likely to be followed by excessive hæmorrhage, which is very difficult to arrest.

OZENA is a disease of the nose and frontal sinuses, characterised by a thin and foetid discharge. The odour of the discharge is peculiar—not a strong but a very offensive fœtor. On examining the nostrils, the mucous membrane seems swollen but not very vascular, rather of yellowish tinge, but in some instances congested. On examining the nose with the speculum in a strong light, if the disease is at all advanced we observe numerous superficial aphthous sores, not larger than the surface of a millet seed. The patients are generally pale and unhealthy looking. In truth, the disease is one of the manifestations of scrofula in most cases, although some elderly people otherwise healthy have told me that the discharge had existed for nearly half their life-

time ; but these are exceptional cases, and in most of them the discharge of thin mucus was chiefly from the frontal sinuses. The treatment of ozæna consists first in using means to improve the general health, by administering iodide or bromide of potassium, cod-liver oil and iron, and generous diet. The local treatment I usually adopt at first is to make the patient apply a lotion of Condyl's fluid to the affected membrane by means of a hair pencil or syringe, and once or twice a day sniff up the fumes of tincture of iodine diffused in boiling water. When the aphthous sores are present they should be brushed over with a solution of sulphate of copper from time to time, the Condyl's fluid being used as an ordinary wash. In many cases great benefit is derived from blisters applied behind the ear. In cases where the membrane of the frontal sinuses is affected, the blister should be applied to the forehead. These cases are always tedious, and exercise the endurance both of the patient and the surgeon.

ULCERATION OF THE SEPTUM NASI is sometimes met with, and has often progressed to perforation before the patient's attention is drawn to it. In most cases it begins in a small pimple or pustule on one side of the septum. This is irritable rather than painful, and the patient does not think of applying for medical advice. The irritation leads him probably to be touching the part, or he picks the pimple, and so an irritable ulcer is formed which gradually eats through the septum. On discovering the hole, the patient becomes alarmed, and seeks surgical aid. Such ulcers almost invariably assume the circular form, their edges are irritable, and the surrounding texture congested at first ; but they often assume a low chronic action from a very early period, with somewhat callous margins, which cicatrise from time to time, and then break out afresh, and so the ulcer extends until the septum may be undermined and give way. In almost all the cases I have seen there have been constitutional causes in operation ; either scrofula, or that and hereditary syphilis combined, or the ulcer has occurred as one of the symptoms of tertiary syphilis. In a few cases it seemed to be the

result of mere local irritation, and in these the cure was correspondingly speedy and complete. You will understand from what I have just said that attention to the constitution generally forms the principal part of the treatment, which must be conducted on the general principles already laid down. The local treatment consists in the direct application of nitric acid to the sore, to destroy the diseased parts, and arrest the action. This should be followed by the use of Condyl's fluid diluted with distilled water, and at a later period lotions of sulphate of copper, or chloride of zinc, may be required to assist the healing process. Patients are often anxious that the opening in the septum should be closed, and are disappointed when they find it does not close under the treatment ; but they should be made to understand that the object is to arrest the spreading of the disease, and that contraction or closure of the ulcerated aperture cannot be expected. Plastic operations, or rather attempts at them, uniformly fail, from the sloughing of any flap introduced, the secretion of the nostril interfering with union ; besides, paring the edges of such an ulcer is almost sure to re-excite the local ulceration.

When lecturing on the subject of lupus, I adverted to the plastic operations which we sometimes have recourse to, with a view of restoring the nose, and remedying deformity. I did so then, warning you against performing such operations until a considerable period had elapsed after cicatrisation of the ulcerated surface. Even after a lapse of time, such cases are liable to recurrence of unhealthy action, and our plastic operations may be unsuccessful. Still, in many such cases, when the disease has been healed for some time, and the patient's general health restored, or in cases where the nose or portions of it have been lost from injury, we have recourse to operative measures to remedy the deformity.

When I was a student, RHINOPLASTIC OPERATIONS were very fashionable, and very great favourites with Mr. Liston. The method he pursued; and which was then generally practised, was a modification of the native Indian plan, represented in the accompanying

woodcut (Fig. 11). The flap was taken from the forehead, and the columna afterwards formed from the upper lip ; the latter a modification first used by Mr. Liston, and one of great importance in whatever method the nasal flap is formed. Albeit there was no chloroform in these days—the operation, a tedious, and, I should think, a painful one—the applicants for improved appearance were numerous, for “pride feels no pain ;” and I well recollect on one occasion seeing three of these operations performed by Mr. Liston in one day, and two of the patients sitting with the nasal flaps hanging down, till the oozing ceased, whilst the third was undergoing the operation.

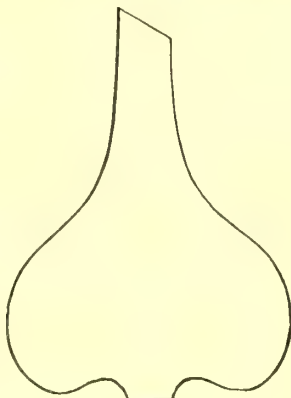


Fig. 11.

But although I had the advantage of seeing the operations of a master-hand, I never was favourably impressed with the results ; more especially as it always appeared to me that the peculiarly disagreeable expression, resulting from the cicatrisation of the large wound on the forehead, more than counterbalanced any improvement from the restoration of the nose. As years passed on, and I had opportunities of seeing many of the patients on whom these operations had been performed, this adverse opinion was confirmed, for the “renaissance,” which had some appearance of a nose when first made, had almost in every case become “small by degrees,” *not* “beautifully less”—in fact, degenerated into a sort of indefinite lump where a nose should be. In some cases, where the original flap had been of such dimensions as to provoke a little merriment at the time of its adjustment, a somewhat better nose remained, but never such as to me seemed any great improvement, whilst the ugly expression caused by the scar in the forehead had certainly not improved. From this feeling, I have never performed the rhinoplastic operation by that method, nor can I recommend it. But in cases where the

cheeks are full, and their textures healthy, and in which the septum nasi is tolerably entire, a very presentable nose may be formed by flaps dissected from the cheeks by the following method :—Two thick flaps of skin, of the form shown in the accompanying woodcut (Fig. 12), are traced on the cheeks, and then

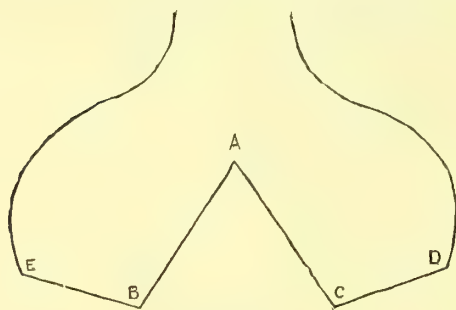


Fig. 12.

dissected up, taking care to retain sufficient substance to ensure vascular supply. These flaps are then brought forward without twisting, and, when all oozing has ceased, the margins A B and A C are approximated and

retained by points of silver suture. The outer margins at E and D are attached by silver suture at such a distance from the openings of the nose as would correspond to the original alæ nasi, and the remainder of the outer free margins implanted into the raw surface by points of silver suture, or small pins pushed in obliquely. After the lapse of forty-eight hours a small dossil of lint may be introduced to raise the flaps and give form to the nose, and that elevation is gradually increased after union has taken place. Lateral pressure from without by forceps made for the purpose may also be used with advantage at a later period, but the effects of pressure must be watched. Lastly, when two or three months have elapsed, and union is thoroughly effected, the columna nasi is formed by cutting it from the upper lip, as first practised and described by Mr. Liston. "The inner surface of the apex is first pared. A sharp-pointed bistoury is then passed through the upper lip—previously stretched and raised by an assistant—close to the ruins of the former columna, and about an eighth of an inch on one side of the mesial line. The incision is continued down, in a straight direction, to the free margin of the lip; and a similar one, parallel to the former, is

made on the opposite side of the mesial line, so as to insulate a flap about a quarter of an inch in breadth, and composed of skin, mucous membrane, and interposed substance. The frænulum is then divided, and the prolabium of the flap removed. In order to fix the new columna firmly and with accuracy in its proper place, a sewing needle—its head being covered with sealing-wax to facilitate its introduction—is passed from without through the apex of the nose, and obliquely through the extremity of the elevated flap : a few turns of thread over this suffice to approximate and retain the surfaces. The flap is not twisted round as in the operation already detailed, but simply elevated, so as to do away with the risk of failure. Twisting is here unnecessary ; for the mucous lining of the lip, forming the outer surface of the columna, readily assumes the colour and appearance of integument, after exposure for some time, as is well known.” The fixing of the columna having been accomplished, the edges of the lip must be neatly brought together by the twisted suture, or silver wire suture, as in hare-lip, after the edges have been raised. “ Some care is afterwards required, from both surgeon and patient, in raising up the alæ, by filling them with lint—thus compressing the columna, so as to diminish the œdematous swelling, which takes place in it, to a greater or less degree, and repressing the granulations. It is, besides, necessary to push upwards the lower part of the column, so that it may come into its proper situation ; and this is done by the application of a small round roll of linen, supported by a narrow bandage passed over it and secured behind the vertex.”

The wounds of the cheeks from which the flaps have been dissected are stitched at the outer parts, and closed as far as can be done without straining the skin. The remainder heals by secondary union, and the contraction which follows rather improves the appearance by projecting the new nose more in relief.

Partial restoration of the nose can be practised with very great benefit by transplanting portions of the cheek texture to supply the deficiency ; and as the opposite side of the nose

and septum are present, the results are very satisfactory. The flaps should be cut with a long and somewhat narrow but very thick pedicle, to avoid the necessity for twisting ; but so thick as to retain ample vascular supply for the flap. Their shape must vary in different cases ; but the accompanying figures will give some general idea of their form. When the

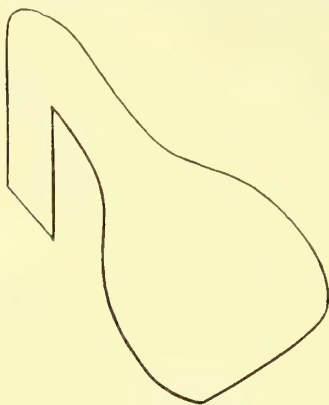


Fig. 13.



Fig. 14.

flaps are taken from the cheek, there is no deformity left from the scar, so that, even if the operation fails, the patient is no worse than before ; whereas, in the forehead flap, great deformity remains. In the case of a lady who, in childhood, had suffered from cancrum oris, which destroyed one side of the cheek and nose, I restored the cheek and form of the mouth by dissecting a flap from the neck, but I could not get sufficient to form the side of the nostril, and I advised her to get an artificial substitute. Eighteen months afterwards, however, she returned, with the determination to have the side of the nose repaired by operation. Of course I could get nothing from the cheek in her case, and I explained my objection to cutting a flap from the forehead. But as she was very determined to have something done, I told her that if she could bear a very irksome after-treatment, I would form the side of the nose from her arm. She at once decided to have it done ; and I accordingly cut a large flap from the inner and anterior aspect

of the upper arm. After paring the edges of the nose and cheek, the flap was fitted and attached by sutures, the arm was supported by an apparatus specially arranged to suit the case, and retained in position for eight weeks before I could venture to sever the attachment of the flap. I was at first rather anxious as to union at the part attached to the margin of the recently-formed cheek, but everything went on favourably, and my patient's firmness was rewarded by a decided improvement in her appearance. I should, however, think very few persons will be found who would carry out the treatment or bear the irksome position of the arm with the determination she did.

LECTURE XCVIII.

Ulcers of the Lips—Epithelial Cancer of Lip : Operations for its removal ; Cheiloplastic Operations—Harelip and Cleft Palate : Operations for the remedy of these Congenital Deformities.

WE have too little time to enter fully into the details of the numerous surgical diseases about the mouth. I shall therefore merely notice the more important points.

The LIPS are subject to various forms of ulceration, some simple, from mere local irritation, the effects of cold, or from disorder of the digestive organs. Such ulcers are generally of an aphthous character, and require little local treatment beyond protecting them from exposure to fresh irritation. The constitutional treatment must depend on the predisposing cause. When speaking of syphilis, I stated that occasionally we meet with chancres of the lip, and mucous condylomata. These latter, when ulcerated on the surface, may lead to wrong diagnosis, as the local appearances very closely resemble those of certain forms of epithelial cancer of the lip, and therefore the surgeon requires to be cautious in his diagnosis, especially when the ulcer is present in young persons, in whom epithelial cancer is not common. In most instances the co-existence of eruptions, or the marks left by eruptions on the skin, and the state of the throat, will confirm his suspicions, if the ulcer be of a syphilitic character, and then the adoption of the treatment proper to that condition will speedily cure the local sore.

The CANCROID AND CANCEROUS ULCER OF THE LIP is most frequently met with in the lower lip in old people, and the exciting cause is often traceable to long-continued local irritation, caused

by smoking a short pipe, or by the presence of some irregular tooth. The characteristics of such ulcers are a warty and villous



Fig. 15.

irregular surface, and extreme hardness of the base of the sore. They vary much as to extent, and the direction in which they extend. Thus, some are confined to a small space of the prolabial surface, but the hardness involves the textures of the lip towards the chin, or angle of the mouth. Others extend very superficially along the length of the prolabium; or the surface and some depth of texture may be affected, whilst the skin and mucous membrane of the body of the lip may be unaffected. The *Treatment* is excision of the diseased part before the glands have become involved. There is no use in trying escharotics, as it will be found that even when the surface of the sore heals after destruction of the ulcer by such means, gland-tumours form in the submaxillary region, whilst their application is much more painful than the operation of excision. We must vary our procedure according to the position, form, and extent of the disease. In the smaller and more defined canceroid ulcer of the lip we

include the diseased part in a V-shaped incision, and remove the part so marked out, taking care to cut wide of the disease. In making the incisions, the texture of the lip should not be stretched by the assistant, as that is liable to render the surrounding hardness less distinct. The bleeding should be commanded by pressure on the facial artery against the lower jaw in front of the masseter muscle, and the lip held loosely whilst the incisions are being made. After the cancerous portion is excised, the vessels are twisted, and the margins of the wound approximated by silver sutures, so that little deformity is left. In cases where the warty ulceration occupies the length of the prolabium superficially, we project the ulcerated surface, and remove it with a pair of curved scissors, and unite the edges of the skin and mucous membrane. If there be some depth as well as length of surface involved, we include the diseased part between the lines of a prolonged elliptical incision, and dissect off the skin and prolabium, remove the diseased structure, and then, after securing the vessels, re-unite the margins of the skin and prolabium. In many cases the disease involves so much of the substance of the lower lip that its removal would necessarily leave the teeth exposed, and allow the saliva to be constantly running out of the mouth. In such cases our procedure ought to be so arranged that we may at once remove the cancerous part, wide of the disease, and at the same time replace it by a substitute lip, formed by what is termed the Cheiloplastic Operation.

Suppose we have to deal with a cancerous ulcer with induration, involving a large extent of the lip both in length and depth, we begin by making two incisions, one from either angle of the mouth, converging at the chin; we then dissect away the triangular part included. By means of these incisions we remove the whole diseased lip, and mark out part of the flaps from which the new lip is to be formed. From the apex *b* of this large V-shaped incision (Fig. 16) we next carry downwards and outwards two oblique incisions to the points *d* and *e*, and then with a curve to *f* and *g*, we mark out two flaps in the submaxillary region. The flaps are now to be dissected from over the

lower jaw and submaxillary region, and detached so far as to enable us to bring them into the positions indicated in Fig. 17,

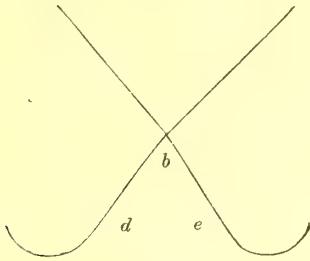


Fig. 16.

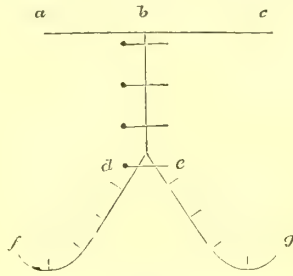


Fig. 17.

of the accompanying woodcut, without straining or twisting. Finally, the cervical wound is closed as far as possible without giving rise to tension. The laxity of the skin in the cervical region allows this to be done to greater extent than we might expect, and the cervical wound heals by granulation.

Various plastic operations are required to remedy partial destruction of the lips and cheek, resulting from cancrum oris, or other causes, but it is impossible to lay down rules for such irregular operations. The surgeon must plan the operation to suit each particular case. In planning such plastic operations, I would refer you to what I said when speaking of plastic operations for removing deformities caused by burns.

HARELIP consists of a congenital gap through the substance of the upper lip, involving its whole thickness. It is sometimes associated with deficiency of texture, and always presents that appearance, owing to a wide gap being caused by the unopposed muscular contraction on either side of the fissure. This gap, or deficiency, not only exposes in an unseemly manner the teeth and gums, but so interferes with the proper functions of the lip as to render eating difficult, and proper articulation impossible. The expression of the face is necessarily very much altered by it, and the discomfort and deformity are generally so great as to induce the parents to seek surgical aid at an early period.

The fissure may be single or double ; and it may be complete or partial in its extent. A complete fissure severs the whole lip, and extends up into the nostril (Fig. 18) ; a partial one

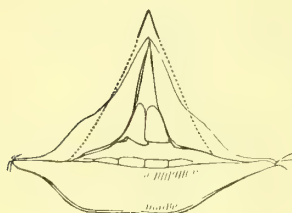


Fig. 18.



Fig. 19.

divides the lip to a greater or less extent, in the same direction, without extending so far as the nostril. Whether there be one or two fissures, neither is ever situated in the middle line, but to one or other side of it ; hence the term harelip does not accurately describe it. When there are two fissures, the groove below the columella of the nose is generally represented by an island or isthmus of sound skin, it being sometimes separate from, and sometimes continuous with, the septum of the nose—generally the latter (Fig. 19). This is taken advantage of in operating, as I will afterwards show you. In addition to this, there is usually an irregularity in the alveolar process, corresponding to either or both notches in the lip. This deformity may assume the character of either a deficiency or redundancy, very frequently the latter. An inter-maxillary bone is frequently present, and projects at the fissure. Sometimes the alveolar process is divided, and a portion of it, with its corresponding tooth or teeth, turned curiously outwards, as if in adaptation to fill up the gap in the lip.

The *Operation* for Harelip may be performed at almost any period of life ; but where you have a choice the preferable time is early infancy, or after the first dentition is complete, and the child two years old. As the lip, after being operated on, is apt to shrink upwards into a modified notch, marking the site of the original fissure, the great desideratum in connection with the operation is a lip free from this defect. With the view of effecting this, it

is desirable to leave a redundancy of texture at the lower portion of the wound. The operation consists in paring or rawing the labial margins of the gap, then placing them together in close and accurate apposition with points of silver suture or harelip suture; but in order to get a redundancy of texture at the margin of the lip, it is necessary to employ either angular or elliptical incisions, both of which I have used with success. The angular incision is begun on either side at a point above the base of the fissure, and brought down in a straight line to the upper margin of the prolabium, where it is directed inwards at an obtuse angle (Fig. 20). Thus, when the two straight edges are brought together, the labial margin will be excessive rather than defective; but the excess will soon be remedied by absorption. You will readily understand that a like result will be obtained, and perhaps in a simpler manner, by

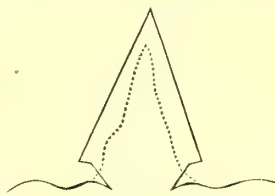


Fig. 20.

employing two curved incisions, their concavities being directed towards each other, so that when the lips of the curves are approximated and brought into line, the lower extremity of the united line will exhibit a redundancy of texture. This is the mode of operation I generally employ, and its simplicity and success have decided me in giving it the preference for most cases of harelip. After the margins have been closed by silver sutures, the mucous surface should be secured by a point of silk suture, to prevent saliva entering the deep aspect of the wound.

The operation for the double deformity is conducted on the same principles, and must, of course, be modified according to circumstances. Where there is an isthmus of skin depending in the middle line, I raise it up and employ it in supplementing the columna of the nose, which is generally defective. This I find to be more advantageous than to pare it into a wedge-like form, and employ it in patching up the new lip, as is sometimes done, as represented in Fig. 19. When the intermaxillary bone is present, we either break its narrow pedicle

and forcibly repress it into position, after dissecting off the soft parts, or we divide the pedicle with bone-pliers, and remove the bone. The former is the preferable method when we can adopt it. In either case it should form a preliminary operation.

The mistake you are likely to commit as beginners is to remove too little texture in paring the edges. This conservatism is suggested by the apparent dearth of material to supply the existing defect ; but that deficiency is more apparent than real. In drawing the edges of the wound together, we have to draw largely on the elasticity of the component textures ; and lest the sutures should of themselves be insufficient to keep the ground we have gained in this way, we generally draw the cheeks towards each other by strips of adhesive plaster, causing the lip to pout.

This can be done more effectually by means of an apparatus, formed somewhat like a double truss, consisting of a circular spring and two pads. The spring is applied round the back of the head, and the pads are adjusted so that one is made to impinge on either cheek. It is kept in position by means of a cross strap applied over the forehead and vertex. I have never myself used this, but it has been found of advantage.

The bleeding must be arrested by torsion. No approximation must be attempted until it has entirely ceased, unless we use the harelip-needles, when these are made to compress the vessels.

Chloroform may or may not be used. If given, care should be taken that the child has had no food for some hours before the operation, lest it cause sickness.

The condition known by the name of *CLEFT PALATE* consists of a congenital malformation, in which the arch forming the roof of the mouth, instead of being continuous and entire, is interrupted by a longitudinal fissure or gap in its substance. This deficiency may be partial, affecting the soft palate only, or it may be complete, involving the hard palate also. Sometimes aggravated forms of it are met with, in which the fissure extends forwards through the alveolus and upper lip into either nostril ; and there are minor degrees of it, in which the fissure is repre-

sented by a short oval slit in the vault of the mouth, bounded both anteriorly and posteriorly by sound parts. Various explanations of its origin have been advanced. Some refer it so far back as to make its commencement coeval with the closure of the first visceral arch in the embryo. Others date it from arrested development at a later period ; while a third theory attributes it to separation of the still imperfect parts by causes distending the foetal head.

The *Operation for Split Palate* cannot be shown properly on the dead subject unless the malformation be present. When the soft palate alone is involved, the operation required is comparatively simple. What we have to do is to pare the edges of the slit in the palate, and bring them in contact by points of suture. The danger is that the tension may cause the sutures to ulcerate out. Moreover, the constant irritation of the part by saliva and foreign substances in the mouth, and the attempts of the patient to swallow, are apt to break up the newly-united edges, and render the after-treatment rather troublesome. Still the operation for the soft palate is comparatively a simple one. Various methods have been proposed to relieve the tension. Sir William Fergusson proposes to divide the muscles which render the palate tense, and also to divide the muscular fibres contained in the pillars of the fauces, the palatoglossus, and palatopharyngeus. This renders the tension somewhat less, but the injury done by interference with the soft textures, and the division of the muscular fibres, may lead to suppuration, and so defeat the object we have in view.

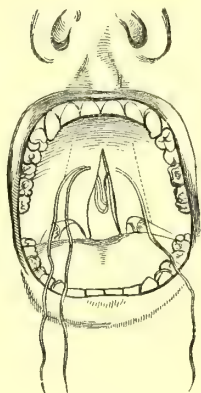


Fig. 21.

In bringing the edges of the wound together, we should use silver instead of silk sutures, as silk creates more irritation than the silver wire. In putting in the sutures, I leave a considerable space between the points where the needle is inserted and the free margin, so that there may be a considerable thickness of texture intervening. Five or six sutures should be inserted

in all. Formerly there was sometimes a difficulty in getting hold of the right ends of the sutures, but an instrument has been invented which obviates this difficulty—a coronet with projecting pegs, to which the ends of the sutures are fixed.

In the other form of the disease there is a split and deficiency in the hard as well as in the soft palate. Langenbeck and others have lately introduced a method of operating for this condition, founded on the researches of Ollier with regard to the periosteum. He fills up the gap in the hard palate by separating the gum-texture, and the periosteum along with it, from the palatine surface, and pushes it in towards the cleft. This operation is much more difficult than the former, and requires much time and patience in its performance. Very careful dissection is required in separating the palate from the arch of the mouth, and the palatine plate of the superior maxilla and the palatine bone proper are generally much more vaulted in such cases than usual. The first thing is to pare the edges, both of the soft and hard palates; then make an incision with a bistoury close to the edges of the gum, on either side, leaving a small portion in front unseparated, so as to preserve its vascular connections entire; then, with a double-edged knife curved on the flat, separate the periosteal texture from the bone. This is done on both sides. It will generally cause considerable bleeding, and we must wait till this ceases before proceeding with the operation. When bleeding has ceased, we bring the parts together by points of suture, but this is not very easily done, and we require to have several needles for the purpose; the spring needle of Langenbeck answers best in most cases. The operation is a tedious one, and in many cases, after all, the result is unsuccessful. As a general rule, I think that the best plan in the more complicated cases, in the case of adults, would be to perform the operation on the soft palate first, and not to complete the whole operation at one sitting; rather than attempt too much. If the operation on the hard palate fails, it is very apt to implicate the soft palate. It would therefore be less troublesome, and more likely to be successful in many cases, to do the two parts of the operation on different occasions.

LECTURE XCIX.

Inflammation and Abscess of the Tonsils—Chronic Enlargement of the Tonsils—
Excision of Tonsils—Ranula and other Sublingual Tumours—Salivary Con-
cretions : their Symptoms, Diagnosis, and Treatment—Glossitis—Chronic
Hypertrophy of the Tongue—Ulcers of the Tongue—Epithelial Cancer of the
Tongue : Operations for its Removal—Tumours of Palate.

THE TONSILS are subject to attacks of inflammation, which may terminate in suppuration. There is great swelling in the throat, with difficulty of breathing and swallowing, and much fever in proportion to the extent of the disease. The patient is often very much exhausted also, from want of food, and much depressed from the irritative fever which is present. All these symptoms may be relieved by making an opening early, if suppuration be suspected to be coming on, for the pus may form very deeply in the tonsil. In no case is there any danger in cutting into the tonsil ; and an incision made to reach an abscess, even though the pus has not formed, can do no harm. It relieves the congestion of the parts, and in fact we often scarify the tonsil, just to modify the inflammatory action. We cannot of course feel fluctuation readily at an early stage of the disease in parts so deeply seated as the tonsil. A common bistoury is the best instrument for cutting into the tonsil, and it should be passed directly backwards in the line of the second molar tooth, the edge being directed inwards, for it is important to remember the close proximity of the large vessels of the neck to the base of the tonsil. There is no danger, however, to these parts, if the knife be passed fairly from before backwards into the abscess of the tonsil, and then carried upwards. The danger of non-interference in such a case is that the abscess may burst in the night, when the patient is asleep, and suffocation occur. From the congested state of the parts, we may, and

indeed pretty often do, have rather smart bleeding when we open the abscess, but we need not be alarmed at this, as it soon stops.

As regards CHRONIC DISEASES OF THE TONSILS, we have chronic enlargement of them with condensation of their texture. In delicate children this very often occurs, and they may attain to such a size that the two tonsils almost close up the fauces, and give rise to difficult breathing, especially at night when the patient lies on his back, and the nares become plugged with mucus. It is altogether a very unhealthy state of matters, for it interferes with the proper aëration of the blood, and therefore the sooner the disease is removed the better. The tonsils, on examination, are seen to be of a pale colour, and of a pretty firm consistence, though occasionally they may be somewhat vascular and spongy; these latter cases being not so favourable as the others. They nearly meet in the middle line, and they also project both upwards and downwards between the pillars of the fauces. In these cases, the simplest and the best treatment is the removal of the projecting portion of the gland—

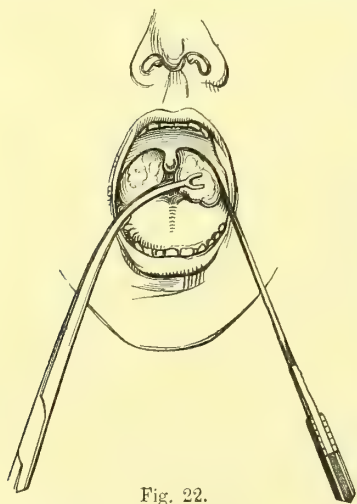


Fig. 22.

Excision of the tonsil, as it is generally called. This is an unfortunate name, for we do not excise the tonsil; we merely cut off a portion of it, and subsequently condensation of the remaining portion of the tonsil occurs, and the part contracts. To remove the tonsil, it should be drawn towards the centre of the mouth with a vulsellum, and then a straight probe-pointed bistoury is passed fairly below the projecting portion of the gland, and carried directly

upwards without any sawing motion, and to effect this the knife must be very sharp (Fig. 22). We should remove both tonsils

at the same time if possible, or the second may be removed a day or two after the first. There is seldom bleeding of any importance after the operation, but we must be careful not to drag the parts too much towards the mesial line, nor to cut too much outwards, for fear of injuring the important vessels. In children, it is sometimes not a very easy operation, from the small size of the mouth and other causes ; and chloroform, though it may be given, does not assist us much. An instrument called the guillotine has been introduced to obviate these difficulties ; but my objection to it is that it does not remove a large enough portion of the tonsil, and, besides, in children it is quite as difficult to use as the bistoury ; still, in some cases, it has been found useful. There is no after-treatment required beyond washing the mouth with warm water, and afterwards with alum gargle, and avoiding cold.

The term *RANULA* is applied to a cystic tumour in the sublingual region. On looking into the mouth we observe that the apex of the tongue is raised, and the body of the organ carried upwards and backwards, whilst the floor of the mouth is occupied by a large prominent swelling of a peculiar bluish tinge from distension with fluid, and covered by the mucous membrane. In some cases there is a sort of double swelling occupying both sides of the mouth ; in others, the tumour occupies only one side, but often presses over beyond the middle line as it enlarges. The swelling of course interferes with the use of the tongue and mouth ; the voice is harsh and croaking, hence the term *Ranula*, from the sound resembling the croaking noise made by frogs. Deglutition is interfered with, and even respiration may be seriously affected ; and in some cases suffocation has been threatened from rapid increase of the swelling. Considerable difference of opinion exists as to the nature of *ranula*. Some consider it a new growth, or true cystic tumour ; others, enlargement of some mucous follicles. Whilst some, with whom I am inclined to agree, consider the growth to depend upon obstruction of the sublingual and sub-

maxillary ducts, leading to gradual alteration in structure of the sublingual gland, somewhat similar to the cystic alteration which we frequently see take place in the pancreas and kidney from obstruction in their ducts. I think this is borne out by the uniformly constant position and relations of the tumour, the slightly sacculated appearance of the cavity when opened, and the double swelling we occasionally meet with. The objection to this view, that the contents are not like saliva, is not a very strong one. In all cases of affections of secreting organs the secretion becomes altered. In this case the secretion is more glairy than saliva, but it does in general contain most of the chemical constituents of saliva. The swelling is quite different in appearance from other independent cysts, with glairy or steatomatous contents, which are not unfrequent in this region, and which can be removed entirely, cysts as well as their contents. In ranula we cannot remove the cyst; it is evidently part of the natural structures.

Whatever view, however, may be taken of its pathology, there is no difference of opinion as to the *Treatment*, which consists in seizing the anterior wall of the swelling with a pair of artery-forceps, and cutting out a large oval portion of the cyst, evacuating its contents, and then painting the interior of its cavity with a strong solution of nitrate of silver, or strong tincture of iodine, to cause obliteration. This plan is usually quite successful, and far safer and less painful than passing a seton through the cyst to procure obliteration, which has sometimes been had recourse to.

Earthy Concretions form in the salivary ducts of the parotid sublingual, and submaxillary glands. THE SALIVARY CALCULUS occurs most frequently in the submaxillary duct, which it obstructs and distends. It gradually compresses a part of the gland-substance, and is felt from the neck. In whatever position these concretions form, they give rise, after a time, to inflammation and suppuration; the matter bursts externally by burrowing, and when it bursts, or is evacuated by the surgeon, there result long tortuous sinuses, which lead indirectly to the concretion,

and saliva continues to ooze through the openings. The irritation caused by repeated attacks of inflammation, and the continued loss of saliva, exhaust the patient. The cause may be overlooked, especially if the sufferer is otherwise of delicate constitution. In the submaxillary region the tumour caused by the concretion may be mistaken for a glandular tumour, and an operation proposed to excise it. This would be a very serious error if acted on, for between the supposed tumour and the skin, there is of course a great depth of parts, including the submaxillary gland, and the facial artery and vein. A little attention to the history of the case, and a careful examination from the mouth, would lead to a correct diagnosis. The remedy is comparatively simple. The concretion is fixed by pressure from below by an assistant, so as to render it prominent towards the mouth, and a free incision is made from the mouth through the mucous membrane directly upon the concretion, which is then easily turned out with the scoop of a director, or seized and extracted by a pair of polypus forceps. There is little thickness of parts, no vessel of any size need be divided, no external wound is left, and little or no after-treatment is required.

INFLAMMATION OF THE TONGUE.—GLOSSITIS may be excited by various causes, but the affection is sometimes apparently dependent on epidemic influences, and then assumes a very formidable character, and demands prompt and decided treatment. The organ becomes swollen, has a tense or brawny feeling to the touch, and is of a dark brown colour, with a sense of burning heat and pain, and the mucous membrane of the cheeks and lips is swollen. The swelling increases with great rapidity, and in some cases which I have seen, when the disease was prevalent here, the tongue swelled so rapidly as to separate the teeth and nearly fill the mouth in less than twenty-four hours from the invasion of the attack. There is a considerable amount of fever

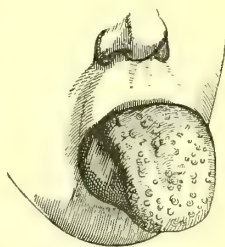


Fig. 23.

anxious expression of face, and difficulty in breathing ; indeed, unless prompt measures be adopted, the swelling of the tongue and submucous infiltration of the mouth and fauces, will speedily suffocate the patient. The *Treatment* of this active form of glossitis consists in freely incising the tongue in the longitudinal direction, keeping the incisions from the middle line. The incisions are made deeply through the infiltrated texture of the tongue, and afford relief, both by depletion, but especially by the escape of serous and plastic exudation, relieving the tension and swelling. The bleeding, in general, is much less than we might at first expect from incisions in so vascular an organ, but the incisions are not made so deeply into the proper texture of the organ as they seem to be. They pass into the infiltrated structure, and when the swelling subsides, the incisions, which seemed deep gashes when first made, appear as mere superficial scarifications. After the incisions are made, tepid lotions of honey and water, with chlorate of potash or borax, should be used to allay irritation, and the chlorate of potash may be given internally with advantage. The constitutional febrile condition must be treated on general principles, and during convalescence the use of quinine is specially indicated.

CHRONIC HYPERTROPHY OF THE TONGUE is not very common. In the cases which have come under my notice, the patients have been young, and the disease had apparently been progressing slowly from childhood, the enlargement proceeding more rapidly as the patient grew up. In these cases, although the tongue was of an enormous size, and hung over the chin, the interference with respiration was by no means such as in acute glossitis. The reason of this is, that the jaws and cavity of the mouth, and openings of the nostrils, seem to be gradually accommodated to the great alteration in the size of the tongue. Indeed, the lower

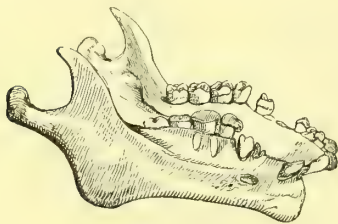


Fig. 24.

jaw, in such cases, is quite altered in form, so as scarcely to resemble the human jaw. This will be seen in the accompanying woodcut (Fig. 24). The treatment used to be excision of a V-shaped portion of the fore part of the tongue, which protruded, and this, though attended with some risk, generally answered well enough ; but it could seldom be done in young children, and when done later, the deformity of the jaw was irremediable. More recently it has been found that methodical bandaging of the protruded part, if combined with the internal use of iodide of potash, is sufficient gradually to diminish the swelling. The bandaging of this unruly organ might seem difficult, but it can be done either with cotton bandage or strips of adhesive strapping, which, however, require to be renewed frequently, and the compression is more easily managed and more effectual than I could have at first believed. I certainly would not now have recourse to excision until I had given this method a fair trial.

ULCERATIONS OF THE TONGUE are very common. In a great many cases they look more formidable than they really are ; in many cases they are dependent on irritation of the gastro-intestinal mucous membrane, and in all cases their appearance is influenced by the condition of the digestive organs. In other cases, the ulceration has been originally caused, and its unhealthy condition kept up, by the local irritation produced by some sharp corner of a tooth, or the fastening of some false teeth, the adjustment of which has become disarranged. In the class of cases I have just mentioned, the treatment is obvious—removal of the exciting cause by filing down or removal of the offending tooth, the proper adjustment of false teeth, or leaving them out for a time till the ulcer heals, and the use of some mild wash, composed of borax, or chlorate of potash, combined with honey or glycerine and water. In more obstinate cases, the best local application is the sulphate of copper. In cases where there is a constitutional taint, such as syphilis, the appropriate constitutional remedies must of course be used ; whilst in those cases where the ulcers evidently arise from, or are kept up by derangement

of the digestive function, the treatment is directed to improve that.

Unfortunately an ulcer of a cancerous nature, EPITHELIOMA OF THE TONGUE (Fig. 25), is too frequently met with, and presents

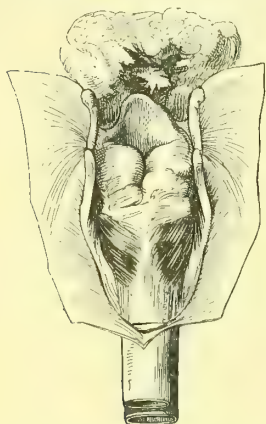


Fig. 25.

the usual history and character of that form of cancer. The only remedy for this is early removal by operation, and even this is not very hopeful. In speaking of epithelial cancer, I said that it was really no more localised than any other form of cancer, and that in patients suffering from this disease, we often find the cancer recurring, not in the part from which it has been removed, but in other parts of the body. I have removed it from the lip, and the disease has returned in the testicle, scrotum,

and elsewhere: it is simply a manifestation of the cancerous diathesis. The disease is quite as much constitutional as any other form of cancer, and the structure affected merely modifies its local character.

The expediency of removing the tongue for cancer will depend on the extent of the disease. If in every case of cancer of the tongue, the disease were localised, the operation of removing the whole tongue might be warranted; but if, as I believe, it is not localised, then, I think, we must deal with the disease according to its extent and position. If the disease occupies a small portion of the tongue only, the best method is simply to remove it by an incision wide of the part, arresting the bleeding by torsion, or by applying the cautery to the surface. Where the tip or upper portion of the tongue is affected, a V-shaped portion may be removed, and the parts brought together after the bleeding is arrested. This enables the patient to retain the power of speech. Or we may strangulate the anterior half of the tongue, and cut off the cancerous mass in front of the ligatures, or the

operation may be effected by the *écraseur*. The removal of half of the tongue, or even of the whole tongue, may be effected in various ways. It has been done in Italy more than once by means of an incision below the jaw—the tongue and os hyoides being drawn out under the jaw-bone, and as much of the tongue then removed as necessary, the vessels being ligatured where they enter the organ. The late Mr. Syme performed the operation by making an incision through the soft parts in the mesial line, from the margin of the lower lip to the body of the hyoid bone, and then dividing the inferior maxillary bone, the two halves of which were drawn aside, so as to expose fully the cavity of the mouth and sublingual region. There is always a very great risk superadded in cutting the bone, and if we can manage the operation any other way, we should do so. In some cases lately, it has been done without any section of bone, by simply drawing the tongue forwards in the mouth. In other cases an incision has been made through the cheek at the angle of the mouth, so as to get a larger opening, and then a knife or *écraseur* passed in and the tongue removed.

Cases of epithelial cancer of the tongue are not very encouraging, for the operation of excision of the tongue is very generally fatal, and even when the patient escapes from the immediate danger, the recurrence of the disease is very rapid. Still, from the intense suffering of the patient, the operation may be had recourse to for the great, though temporary, relief which it affords. The diagnosis of these cases is, however, very important. In a case I saw lately, the patient was suffering from what seemed to be very marked malignant disease, but which turned out to be merely a chronic syphilitic affection of the tongue. The patient recovered after tracheotomy had been performed. There was no malignant disease present, but simply a chronic thickening and ulceration of the back part of the tongue.

We occasionally meet with tumours developed in the covering of the hard palate, or in the substance of the soft palate. These growths are generally of a benign character, and of fibrous structure ; sometimes, though rarely, fatty, but firmer than the

ordinary adipose tumour. In many cases these palatine growths are of considerable size, and pendulous ; at other times we find the tumour imbedded in the palate, but loosely connected. In either case their removal is obviously the proceeding to be adopted, and this is easily accomplished. In the case of pendulous tumours, the root of the pedicle should be included in an elliptical incision, to divide the substance of the palate around it, and then either twisted or cut out, so as to leave no portion of the pedicle. Those tumours which are imbedded in the substance of the palate are removed by a longitudinal incision through the palate directly upon the growth, which is then fixed with a sharp hook, and readily turned out with the handle of the scalpel. In the cases on which I have operated I have never required to tie any blood-vessel.

LECTURE C.

Diseases of the Jaws—Abscess of the Antrum of Highmore : its Symptoms and Treatment—Abscess in Lower Jaw—Epulis—Cystic Tumours of Upper and Lower Jaws—Simple and Malignant Tumours of the Jaws—Excision of the Upper Jaw—Various Methods of performing the Operation—Excision of the Lower Jaw—Partial Resections—Disarticulation of the Lower Jaw—Excision of the Central Portion of the Lower Jaw.

THE upper and lower jaws are frequently the seat of diseased conditions which require operative procedure for their cure. The forms of disease most frequently met with in the maxillary bones or their coverings are—abscess of the antrum of Highmore in the upper jaw, or abscess in the body of the lower jawbone, with expansion of its structure ; epulis, cystic and fibrous tumours, osteo-sarcoma and osteoma amongst the simple growths ; and the different forms of medullary tumours, from those of fibroid or fibro-plastic structure to those of true cerebriform consistence, amongst the malignant growths. Tumours of the latter class are, unfortunately, much more common than the simple.

ABSCESS OF THE ANTRUM is a very common affection, and, in general, is easily diagnosed, although under some circumstances it may simulate more serious disease of the upper jaw. The abscess is usually the result of inflammation of the lining membrane of the cavity, caused by cold or the irritation from decayed teeth or stumps, and not unfrequently from the pivoting of artificial teeth leading to irritation. The symptoms are intense pain and tension felt in the part, the pain very similar to tooth-ache. There is considerable fever, then acute œdema of the cheek supervenes, and, on examining from the mouth, the mucous membrane is seen to be tense, and the anterior wall of the antrum is felt to bulge forwards, and has a peculiar elastic feeling to the touch.

If the disease has occurred slowly, more in the form of chronic than acute abscess, the symptoms are modified in their intensity, and after a time pus and mucopurulent matter escape through the opening from the antrum into the middle meatus of the nose, when the patient is recumbent, and the matter is felt passing downwards. The early or palliative treatment is to remove all obvious sources of irritation, and to allay pain by opiate fomentations to the cheek. So soon as we are satisfied that there is pus in the antrum, we should extract the tooth corresponding to the cavity, and perforate the alveolus into the antrum. This, however, is rarely sufficient. We must make an opening through the anterior wall of the cavity with a stout bistoury, and, if necessary, remove an oval portion of the parietes of the antrum. Thus a free escape of pus is permitted, and we can thereafter syringe out the cavity twice a day, and inject weak stimulating lotions to promote the cure.

IN ABSCESS IN THE LOWER JAW, owing to the increased thickness of the bone corresponding to the purulent collection, diagnosis is often very difficult, and we must trust chiefly to the history of the case in connection with the appearance of the affected jaw. In some instances we may be obliged to make an exploratory perforation to make quite sure. In many cases the oozing of matter by the side of a tooth will guide us to the right conclusion; and if there be any decayed or loose teeth, it is advisable to remove them, and then the escape of matter will at once satisfy us of the presence of an abscess. In some instances the osseous walls of the bone expand without thickening, and become like parchment. Then the diagnosis is easy, and the treatment equally so. An opening is made in the expanded bone with a bistoury, and a portion cut out to permit free vent for the pus. In those cases where the bone is thickened, we require to use a small trepan to perforate the bone. After evacuating the pus, the same treatment is adopted as in the case of abscess in the upper jaw.

EPULIS is a fibrous tumour arising from the gum-texture, and resembling it in structure, but prominent and irregular on the surface. It is a perfectly simple growth, and generally arises in connection with irritation from decayed teeth and an unhealthy state of the alveolar process. In excising the tumour, it is always advisable to remove the underlying portion of the alveolus with the cutting pliers, to ensure complete removal of the growth, and any likely source of irritation. In some cases, when the tumour is merely cut off from the gum, it returns. This is not due to any malignant tendency, but only because the tumour takes its origin from the periosteal covering of the alveolar process, and has not been thoroughly removed ; hence the propriety of making sure by removing the portion of the process corresponding to the tumour.

CYSTIC TUMOURS OF THE JAWS are very common. In the upper jaw, the cyst is generally in the antrum, and in some cases of chronic abscess of the antrum, the general appearances and symptoms are not unlike. Indeed, in many cases, suppuration in such cysts often occurs in consequence of irritation. In one case of a young woman, both sides of whose upper jaw were affected, I found that the cavity on the one side contained the ordinary glairy cystic fluid, whilst on the other side the antrum was distended by thin purulent matter. The cystic tumour is distinguished from the acute abscess by the absence of febrile symptoms, and the acute œdema of the cheek, and also by the slow and regular increase of the swelling.

The *Treatment* is very similar to that of abscess of the antrum. We open the anterior wall of the cavity, and remove a portion of it, sufficiently large to enable us to evacuate the contents of the cyst, and apply tincture of iodine or solution of nitrate of silver to the interior of the cyst, to destroy its secreting structure. The osseous walls are in general so thin, almost resembling parchment, that there is no difficulty in opening them with a common bistoury and removing an oval portion with curved scissors.

CYSTIC TUMOUR OF THE LOWER JAW is also a not uncommon affection. In some instances, it is simple cystic expansion of the bone, and is usually situated near the anterior surface. In such cases, all that is required is to open it up, and with a small pair of bone-pliers, cut away as much as possible of the projecting anterior wall of the cyst, and then apply nitrate of silver or chloride of zinc to destroy the remaining cystic surface. When this is done, the cavity granulates, the thickening around becomes absorbed, and the cure is completed. But if the growth returns or fungoid projections take place, or if the cystic tumour be large and multilocular, then the safest practice is to excise the portion of the jaw in which the growth is situated, wide of the disease.

The other forms of tumour to which the jaws are chiefly subject are—osteoma, osteo-sarcoma, fibrous tumours, and the different forms of malignant growths, and present the usual characters and history of such tumours. When speaking of malignant tumours of bone I referred specially to the tumours of the upper and lower jaws, in regard to their peculiarities, so that I need not dwell on them again. In all the simple tumours there can be no question of the propriety of their early and complete removal, before they involve a large amount of the bone, or over-distend the skin, or become adherent to the soft parts from inflammatory action. At the same time, the bulk of the tumour, supposing it to be simple, is no objection to its removal, nor does it much increase the difficulties of the operation, unless the soft parts have ulcerated from pressure, or become adherent. In the upper jaw especially, a large firm tumour, such as that represented in the accompanying woodcut (Fig. 26), is often removed with greater facility than a small one, from the amount of leverage which it affords, and because the osseous connections are thinned by the pressure of the growth. In large simple tumours of the upper jaw, in which the skin is tense, thin, and adherent over the tumour, by carefully planning our incisions, it is surprising how little difficulty arises in bringing the parts into contact without overstretching them ; whilst, even in extreme cases, plastic

operations enable us to fill up the gap. In one case of malignant tumour of the upper jaw, which I alluded to when lecturing on



Fig. 26.

malignant tumours of bone, and in which all the soft textures of the cheek required to be removed with the growth, I dissected a large flap to form a new cheek, and the patient made a good recovery at the time, although she died about two years afterwards from recurrence of the disease in the superior maxilla of the opposite side. The appearance of the patient immediately before and after the operation, is shown in Plate xlv. Figs. 1 and 2.

I shall now proceed to the operations required for the removal of such tumours.

In the lower jaw, even malignant growths, being more circumscribed anatomically, if they arise in the interior of the inferior maxillary bone, may be removed by operation with better chance of success than in the upper jaw. For in the case of tumours arising in the antrum, we have not the same limitation. Very generally in such cases the disease, before it shows itself towards the face, has affected the base of the cranium. Such soft growths, indeed, often arise in the ethmoid cells, and

then we cannot extirpate the whole of the disease. In tumours of a more fibro-plastic character, and less rapid growth, however, we may give the patient the benefit of the operation, though the disease may possibly recur. A good practical rule in regard to tumours of the upper jaw is, not to interfere when there is projection of the eyelids and eyeballs with eversion of the eye, the latter symptom especially, shows that the tumour has commenced in the ethmoid bone, and is bulging outwards the contents of the orbit.

IN EXCISION OF THE UPPER JAW the lines of incision will depend entirely on the size of the tumour. Sometimes an incision made in the middle line of the upper lip will enable us to lift up the upper lip and cheek, and remove the tumour ; for we must keep in mind that the mobility of the soft parts forming the cheek, and the opening of the nostril, give us great space when the lip is divided, and enable us to remove a tumour of some bulk, affecting only the body or lower part of the superior maxillary bone. If the malar bone or floor of the orbit be involved in the disease, or require to be removed, then we enlarge the incision upwards along the side of the nose towards the inner canthus, and are thus enabled to dissect back a flap sufficient to expose the parts beyond the tumour on each side. The incisor teeth should always be extracted before beginning the operation. To divide the osseous connections, we require, after division of the soft palate, to introduce a narrow saw into the nostril, and saw very deeply in front through the bone, and then with a pair of bone-pliers we cut through the nasal process of the maxilla, and then saw through the bone at its outer attachment with the malar. In all cases we divide the covering of the hard palate longitudinally, and the soft palate transversely out towards the tuberosity of the jaw.

It is very rarely, however, that the superior maxilla alone is affected, and in cases such as that represented in Plate xlv. Fig. 3, we require to dissect a larger flap by a rather different form of incision. We first make the same incisions as last

Fig 2



Fig 1



Fig 3





described, and then cut outwards along the lower margin of the orbit. The large flap thus marked out, when dissected off the bone, lays bare the entire surface of the upper jaw and malar bone, and enables us to remove a tumour of any size. We must be very careful in clearing the floor of the orbit; a thin copper spatula should be used to guard the parts within that cavity. The malar bone is generally very dense, and requires a deep section with the saw. It is sometimes very difficult in such cases to get the soft palate divided properly, owing to the tumour being close to the teeth, and pressing down towards the tongue. When we remove the whole of the upper jaw in this way, the wound is entirely in front of the soft palate. When all the bleeding has been arrested some slips of lint are introduced into the large gap left by the removal of the jaw to support the cheek-flap, which is then adjusted. These slips of lint are removed in a few days through the opening in the palate. The surfaces generally heal by the first intention, and very little deformity is left. (See Plate xlvi. Fig. 2.)

Excision of the whole upper jaw and malar bone, for these large tumours, may also be effected by means of a single oblique incision through the cheek. The incision is commenced above the zygomatic process of malar bone, and carried obliquely downwards and forwards to the angle of the mouth. The soft tissues of the cheek, lip, and ala of the nose are then detached, and drawn upwards and inwards, so as to expose the body of the tumour, the nostril, and ascending or nasal process of the maxilla. The attachments of the temporal muscle in the zygomatic fossa are next separated. The soft palate and the osseous connections of the tumour are then divided, and the jaw removed as in the operations already described.

The method of operating for EXCISION OF THE LOWER JAW will depend on the nature and extent of the disease. In simple growths, all that is required is to remove the tumour, together with a portion of sound bone on either side of it, for there is no tendency to reproduction in these cases. For example, if a firm

tumour of a non-malignant character exists in the lower jaw, we do not require to remove the angle of the jaw or the chin, but merely to go a little beyond the tumour on each

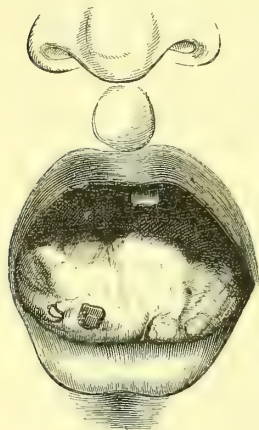


Fig. 27.

side ; and in such cases as that represented in Fig. 27, affecting the centre of the lower jaw, we do not require to remove the lateral portions of the bone, when we merely require to remove the tumours along with a small portion of the jaw on either side of it, and we may do this and leave very little deformity. In a case I operated on lately for disease of the bone, the diseased portion included nearly the two-thirds of the horizontal portion of the jaw, and yet it was removed with hardly any external incision. I merely made a small incision

on either side, to allow me to introduce a small saw to cut through the bone. The lip was then turned down without cutting it, and the mucous membrane and soft parts separated from the bone. The precaution was taken to fix the point of the tongue, which might retract and turn upon itself, and suffocate the patient. In any tumour not involving the angle of the jaw, this plan may be followed out, without making any large external incision, and merely leaving a small opening for the escape of the discharges from the wound, if necessary. In other cases, where we have a tumour of the lower jaw occupying nearly the whole of one side of the bone, if the tumour be at all of a doubtful character, the whole lateral portions of the jaw ought to be removed by disarticulation, because if we leave a portion, such as the angle of the jaw, then if the disease should return, and we subsequently require to disarticulate, the difficulty of doing so becomes very great from the want of leverage, and in some cases the use of forceps to grasp the bone will not answer, as the bone is soft, and gives way under their pressure. Then we require to dissect the part out, which is both difficult and dangerous. Hence, I think, the best plan in all

such cases is at once to remove by disarticulation the whole lateral portion of the jaw at or within a short distance of the symphysis.

The operation of **DISARTICULATION OF THE LOWER JAW** is performed in various ways. At first it used to be done by means of an incision made from the angle of the mouth running upwards towards the zygoma, and another from the lip obliquely downwards to below the base of the jaw. The large flap so formed was dissected back, the bone then sawn through near the symphysis, the temporal muscle divided, and the bone exposed at its articulation, and readily removed. But this method left two very ugly scars across the face, and the mouth was divided at two points. Another objection was that there was no small risk of dividing the parotid duct, and it makes a great difference, whether we divide the main duct or merely branches of it. In cases where the substance of the parotid gland is cut, we have a little saliva oozing out for a short time, but this disappears gradually; but when the duct is partially wounded, we find generally that the saliva makes its way out by the wound, and so keeps it open. The principal objection, however, to this method was the great deformity left.

The method generally adopted now is to begin the incision above the articulation, and in front of the temporal artery, carrying it deeply down to the bone along the ascending ramus of the jaw, and carrying it forwards under the horizontal ramus till we come to the point where the section of the bone is to be made, and then curve it gently up towards, but without dividing, the lip.

In making this incision, the facial artery should be secured before being divided, or it may be commanded by acupressure applied to the vessel below the jaw. The large flap marked out is dissected rapidly upwards and inwards, and the bone exposed. A narrow bistoury is passed towards the inner side of the jaw, so as to clear the bone, which is then sawn through to a certain extent, and divided with the bone-pliers. By using the divided ramus as a lever, the coronoid process is brought well down, to enable us to feel it, and so to divide freely the attach-

ments of the temporal muscle. Then the jaw is turned outwards, and readily disarticulated. There is not much risk of wounding the maxillary artery if we open the joint in front, and keep the edge of the knife close to the bone.

This is the plan I usually adopt, but as regards its results, it seems questionable whether the two scars caused by the old method, or the effects of this plan, leave the worst kind of deformity. There is no scar left in this method, but there is often complete paralysis of the face, from the trunk of the portio dura being divided in the operation, which it was not in the old method. The only way to remedy this evil is to make the incision along the base, and merely curve it up slightly over the angle of the jaw in raising the flap, and then dissect very close to the bone, so as to avoid the trunk of the portio dura. This renders the disarticulation more difficult, but then there is no loss of nervous power or expression, there is less inequality in the two sides of the face, and no twisting of the features. In cases where the tumour is very large, however, we can scarcely do this, for then we require to make a very free incision to enable us to disarticulate easily and safely. After securing the bleeding vessels, the line of incision is accurately closed by points of silver suture. The patient should be desired to lie on the opposite side, to prevent the saliva or discharge resting in contact with the wound.

Some details require to be specially attended to. In making our first incisions, the facial artery should be ligatured if possible before being divided, for it bleeds very profusely, and may give a great deal of trouble. Of late, in excising either the lower or upper jaw, I have used acupressure on the facial artery below the jaw to command the bleeding from it, both during and after the operation, with great advantage. The teeth corresponding to the point of section of the jaw should be extracted before the operation. The flap must be dissected up very rapidly, and the edge of the knife kept directed towards and close to the bone. The bone is cleared a little external to the symphysis, and sawn through there. We should not attempt to divide the bone with cutting pliers too soon. The saw should

EXCISIONS OF THE JAWS.

Plate XLVI

Fig.1



Fig.2



Fig.3





be principally used, and made to act chiefly on the base of the jaw, which is the densest part of the bone, then the division of the bone completed by the bone-pliers. The key of the operation in disarticulating the jaw, is free and early division of the temporal muscle at the point of attachment to the coronoid process of the jaw, and then forcing the jaw outwards. In general, when after section of the horizontal ramus we depress the jaw, the coronoid process can be readily felt, and by cutting upon and around its point, the narrowest attachment of the muscle is divided. In one case, in which I operated for osteo-sarcoma, the coronoid process was so altered in structure as not to be distinguishable by the finger, so I cut through all the textures with the bistoury, but finding that the point of the process still remained in the muscle left, I drew it down with a vulsellum, and removed it.

The method of excising the central portion of the lower jaw will depend on the nature and extent of the disease on account of which the operation is undertaken. I have alluded to a case in which I effected removal of the symphysis, and a large portion of the base of the lower jaw, with scarcely any external incision—merely two small incisions to enable me to introduce the narrow saw to divide the bone on each side, and then separated the detached portion from within the mouth. But when there is a large or projecting growth, such as that shown in Fig. 28, we must proceed differently. In some cases, by means of a free incision along the inferior margin of the base of the jaw, with a little dissection we clear the lower lip from the bone, and draw it upwards, next clear the bone from its attachments on its inner surface, and saw it through on each side wide of the tumour, and so remove it. In other cases we may require to make an incision through the lip in the central line, and another at a right angle to it along the base of the jaw, reflect the flaps, and saw through the bone at each side, detach the soft parts from the inside of the jaw, and thus remove the diseased part. In some respects, so far as the manual procedure is concerned, the excision of the central portion of the jaw may seem,

and indeed is, a comparatively easy operation. But, however performed, it is a very dangerous one, and the danger is peculiar ; it consists of the risk of suffocation from retraction of the os hyoides



Fig. 28.

and tongue, when the attachments of the mylo-hyoid, genio-hyoid, and genio-hyoglossi muscles are divided from the bone. To avoid the immediate risk during the operation, we fix the tongue by means of a strong ligature passed through it near its tip, and held by an assistant. In most cases this suffices, as the tendency to retraction generally soon passes off. We cannot, however, trust to this, as fatal cases have occurred at a later period, and hence in all cases the ligature through the

tongue should be fastened to the inside of the lip or to a silver wire stretched between the teeth on each side of the section. In a case which I recorded in 1842, where I required to disarticulate the lower jaw of a woman, in whom the opposite side of the jaw had been previously removed, I determined to leave the symphysis, to obviate the risk I have just mentioned ; and, supported as it was by the old cicatrix of the soft parts, it effectually prevented it, and permitted a greater use of the incisor teeth than I had anticipated. (See Clinical Cases.)

After operations for removal of portions of the lower jaw, the use of the simple apparatus first suggested to Mr. Liston by the late Mr. Nasmyth of this city will be found of great service in preventing twisting of the remaining parts of the jaw. The apparatus consists of a case of caps fitted to the teeth of the upper and under jaw of the sound side. This is prepared before the operation, and then fitted on so as to retain the sound portion in position, and prevent twisting of the face. This apparatus is also useful in some cases of fracture of the jaw.

LECTURE CI.

Fracture of the Upper Jaw—Fractures of the Lower Jaw at different points : Causes of Displacement ; Treatment—Dislocations of Lower Jaw : Method of Reduction—Injuries of Ear—Foreign Bodies in the Ear, and Modes of removing them—Obstruction of External Passage by Inspissated Cerumen—Eczematous Affection of Auricle and Passage—Otitis—Otorrhœa—Polypi and Polypoid Growths in the External Passage—Affections of the Eustachian Tube—Eustachian Catheterism—Use of Toynbee's Artificial Membrana Tympani.

FRACTURE OF THE UPPER JAW is not common, except as the result of direct force, such as a blow, or a kick from a horse. In general the injury is easily diagnosed on account of the swelling and the mobility of the alveolar process. In a case lately under my care in hospital, there was a displacement which might have given rise to a difficulty in the diagnosis. The case simulated one of dislocation of the lower jaw—the molar teeth of the upper jaw were pushed downwards, and did not correspond to those of the lower, the mouth could not be closed, and the lower jaw seemed to project. But it was merely the back part of the lower jaw which was pushed down, and, on examining the parts fully, the injury was easily diagnosed and remedied. The treatment of fracture of the upper jaw is to model the parts into position as far as possible, and then to apply a bandage or handkerchief, to retain the jaws in apposition.

FRACTURES OF THE LOWER JAW are very common, and may occur at almost any point of the bone—through the angle of the jaw, for example. Not uncommonly we have a double fracture, the jaw giving way at the angle, and at a point a little to one side of the symphysis on the opposite side of the jaw, or on both sides of the symphysis. In these cases we find that the gum-texture is

generally torn, so that the fracture may almost be called a compound one; but it is not a compound fracture attended with any danger, for there is merely a slight laceration of the gum. True compound fracture of the jaw, with an external wound, is usually a very severe injury. In fractures of the jaw, the teeth are generally displaced; the last molar tooth is sometimes split up, and the fragments remain in position, and we must examine for this at the time, as the sooner the split portions of the tooth are extracted the better. This should be done at first, and we should see that the fangs of the tooth are taken out, for if left in they may cause necrosis after the fracture has united.

In these, as in other fractures, the displacement is due partly to the direction of the force inflicting the injury, and partly to muscular action. When the fracture is at or near the angle of the jaw, very little displacement occurs, because the portion of the masseter muscle attached to the outer surface of the bone, and the internal pterygoid attached to its inner surface, mutually counteract each other, and maintain the fracture in position. When the fracture is nearer the chin, the angle is kept pretty much in position, but the action of the mylo-hyoid tends to draw inwards the body of the jaw, and so gives rise to slight displacement. When there is a fracture near to and on both sides of the symphysis, that part, deprived of its lateral support, is acted on by the mylo-hyoid and depressor muscles of the lower jaw, and displaced downwards and backwards, and there is generally considerable deformity. In fracture of the neck of the condyle, the external pterygoid being unopposed, we might expect considerable displacement, but in several cases which I have seen scarcely any deformity existed.

The *Treatment* of fractures of the lower jaw is very simple. We model the fractured portions into position, and fix the jaw by bandaging. When the teeth are tolerably complete, or even when only one or two teeth remain in the lower jaw, if we can oppose these to corresponding teeth in the upper jaw, they serve as fixed points for applying pressure. But if the teeth are very irregular,

so that we cannot do this, then we are recommended to insert some substance—say a wedge-shaped piece of cork or of gutta-percha, or Nasmyth's apparatus—on each side between the jaws, to keep the lower jaw from twisting. This, however, is not often necessary. The only case in which such an apparatus should be inserted, is when the patient has a perfect set of teeth, without any having been displaced. If we do not use it under these circumstances, the patient cannot be easily fed. In most cases, however, all that is required in the way of treatment, is to keep the teeth of the upper and lower jaws fixed against each other; and this is done by applying the four-tailed split cloth or bandage round the jaw and head, as represented in Plate xvi. Fig. 9. Formerly pasteboard splints were put on the jaw, but these are really of very little use.

DISLOCATIONS OF THE LOWER JAW are of two kinds—the complete or bilateral, and the incomplete or unilateral. The unilateral dislocation is attended with greater deformity than the other, owing to the open and distorted appearance of the mouth, and the twisting of the features occasioned by it. In bilateral dislocation there is less distortion, and the opening of the mouth might even be overlooked. The dislocation is generally occasioned by some sudden exertion of the patient, as in yawning or laughing immoderately. Under these circumstances the coronoid process slips forward and gets fixed, whilst the condyles glide from the glenoid cavity in front of the root of the zygomatic process. There is a hollow felt at the articulation, and the line of the teeth does not correspond with that of those in the upper jaw. These conditions, together with the inability of the patient to speak, show the nature of the injury.

The method of reducing the dislocation, whether unilateral or bilateral, is very much the same. Our object is to bring down the coronoid process and condyles from where they are fixed, to allow the temporal muscle to act on the displaced bone, and this is done by raising the chin while we depress the angle of the jaw. The thumbs are placed on the last molar

teeth, and the fingers under the chin. By means of the thumbs we then depress the angle of the jaw, and push it backwards, whilst the chin is tilted forwards, and in this way the dislocation is in general easily reduced. Some recommend that the thumbs should be wrapped in a handkerchief or towel, to protect them from being bitten, when the condyle becomes replaced suddenly by the powerful action of the temporal muscles. I have never seen any great necessity for this precaution, and if the operator does not take care of his thumbs, he may be none the worse of being taught by experience. The bilateral dislocation is in most cases somewhat more difficult to reduce, but still it is easy enough generally. After the reduction has been effected, we must apply a bandage, and keep the jaw fixed for some time, as this dislocation is very apt to recur when it has once happened, especially in females of a hysterical temperament, in whom dislocation of the jaw is not uncommon.

In regard to INJURIES AND DISEASES OF THE EAR, the limits of the course force me to confine myself to a general view of the more ordinary accidents and diseased conditions which you will have to deal with in general practice ; and even with these I must deal briefly.

Wounds of the external ear, or auricle, are not uncommon, but require no special treatment. In some instances the whole auricle, or large portions of it, are detached, and the result is very great impairment of hearing on the injured side. In cases where the whole auricle has been carried away, the patient must have had a very narrow escape for his life. In one, which occurred in my hospital practice some years ago, a railway porter was thrown down by the tender of an engine, and his ear detached except at one point, where it was held by a thin slip of skin. This was cut through, and the patient did well ; but his hearing on that side was nearly lost. I got an ear modelled in vulcanised india-rubber, to serve as a substitute ; and this did assist his hearing a little. A late highly respected physician of this city, who in his youth had been an officer of

light infantry, had the greater part of his ear carried away by a round shot at the battle of Waterloo ; so that, in both these instances, the head must have had a very narrow escape.

We are frequently called on to remove foreign bodies which have been pushed into the external meatus. These accidents generally occur in young children, and the substances inserted are very various—small stones, peas, glass beads, and the like. Here, as in similar accidents in the case of the nostrils, abortive attempts are too often made before the little patient is brought to the surgeon, and the difficulty of removing the foreign body very much increased thereby. In proceeding to extract foreign substances from the ear, we must bear in mind the delicacy of the organ, and risk of exciting diseased action in the middle and internal ear, and the danger consequent on the close proximity to the brain, more especially in young children ; for death has sometimes followed violent or ill-directed attempts at extraction. In cases where the child is brought to us before any interference has been attempted, if the substance can be readily seen, there will be no great difficulty in removing it. The patient's head being firmly held, a small lever-scoop should be passed fairly over and beyond the foreign body, and then the handle of the curette raised, and the instrument used as a lever, to tilt out the substance if impacted ; or, if it be loose, the curette is merely used to draw it out. In cases where attempts have been made to extract the substance, and in which it is deeply impacted, we must proceed very cautiously, as the membrane of the tympanum may have been ruptured, and the foreign body impacted deeper in the middle ear ; and I have known instances in which the promontory of the tympanum has been mistaken for the offending substance. In all such cases of impaction it is essential that the surgeon should see the foreign body ; and, as the membrane of the meatus is swollen, and the passage blocked up or encrusted with blood, this must be cleared away. The first thing, therefore, that we should do, is to syringe out the passage with tepid water ; this will allay the irritation and remove the coagulated blood, and then, by means of the tubular

speculum, we can ascertain the presence and position of the foreign body, which the lever, or ear-forceps, may be used to remove. I have already said that no violent or hap-hazard efforts should be made with instruments. In some cases I have found a stream of tepid water, forcibly injected from a syringe, succeed, when violent efforts with instruments had failed. I would advise this last-mentioned method to be used in the first instance in cases where glass beads are impacted, as these are liable to break in using the lever, and the fragments may lacerate the passage. After the foreign body is removed, if there be much irritation, the child should be kept very quiet, soft warm poultices applied over the ear, and other means used to allay the irritation, and obviate inflammatory action.

In both children and adults insects sometimes enter and lodge in the passage, or deposit their larvæ in it, and give rise to great irritation, and the cause is not suspected. When their presence is ascertained by means of the speculum, they are easily enough destroyed and removed. A few drops of tincture of iodine diffused in warm water, or a very weak solution of carbolic acid injected into the ear, speedily destroys and dislodges them.

The passage of the ear is often blocked up by masses of hardened cerumen, and the patient rendered deaf in consequence of the obstruction. In such cases the ear should be syringed with a tepid solution of bicarbonate of soda, or soap and water; and if the masses of cerumen be very hard, the curette may be used advantageously to assist their removal. Thereafter a little warm oil should be dropped into the passage, and the patient taught to use a small syringe occasionally to prevent re-accumulation. In other instances an opposite condition is met with—a want of the ceruminous secretion, and dryness of the passage. After considerable experience in diseases of the ear, I believe this condition to be very rare as a cause of deafness; but it is so occasionally, and when present, the use of glycerine ointment—one part to eight of lard—will be found useful. It should be heated and applied with a hair pencil, and the passage should be

gently washed out with some weak alkaline lotion from time to time.

The auricle, and the lining membrane of the external passage of the ear, are frequently the seat of a troublesome eczematous affection, attended with considerable local irritation, and which, if not checked, might lead to chronic disease of the membrane of the tympanum. The auricle and lining membrane are red and glazed, and covered with a sort of scurf or scaly coating, beneath which a thin exudation is poured out. There is intolerable itching, and occasional exacerbations of an inflammatory character. The best treatment is to apply to the parts a weak alkaline lotion, such as bicarbonate of soda, or borax dissolved in water, to which a little glycerine is added. After each application, a liniment composed of olive-oil, lime-water, and glycerine, is painted on the surface. When the disease is very obstinate, a small proportion of tar-ointment may be added to the simple liniment. Internally, the use of sulphuretted waters is often of great service in promoting the cure.

INFLAMMATION OF THE EAR.—OTITIS is fortunately in most instances limited to the external ear. Owing to the nature of the structure affected, it is an extremely painful affection. The pain extends over the side of the face and head, and is aggravated by movements of the jaw, as in mastication. There is often fulness or swelling in the parotid region—redness and turgescence at the external meatus, and considerable constitutional disturbance and febrile action. In cases where the inflammation attacks the tympanum, the pain is intense, and accompanied by redness, pain, and swelling in the throat, with severe headache and sleeplessness. Occasionally the mastoid cells and the internal ear become affected, and then all the symptoms are aggravated, and the condition is a very dangerous one. Besides the symptoms already enumerated, we have pain, redness, and tension over the mastoid process and temporal bone in its vicinity, and the pain is intensified on pressure over the squamous portion of the temporal bone or the mastoid process. The consti-

tutional disturbance is very great, and in the character of the headache, watchfulness, anxious expression of countenance, and febrile excitement, resembles symptomatic meningitis.

In the cases in which the inflammation is limited to the external ear, the *Treatment* consists in applying leeches in front of the ear, or behind the auricle over the front of the mastoid process, fomenting, or applying poultices over the ear, and dropping a little warm oil and morphia into the passage, whilst the constitutional disturbance is treated by clearing out the bowels and giving anodyne diaphoretics. Not unfrequently this condition is caused or kept up by the presence of carious teeth or stumps, and the removal of these should be insisted on. When the inflammation attacks the deeper parts of the ear, the danger is very great, and our treatment requires to be energetic. If there be pain, tension, or boggy feeling over the mastoid process and temporal bone, an incision should be made over the mastoid process. This will both deplete freely and directly the parts affected, and relieve tension. Poultices should be applied to the ear, and a blister to the nape of the neck. At the same time, a moderate dose of calomel should be given, and followed by a saline purgative to act freely on the bowels; and subsequently, antimony with opium, in small doses, to diminish the force of the circulation and to act as a diaphoretic. Should rigors occur, with feeling of increased tension, or feeling of fullness in the ear, we should examine with the speculum; and if the membrane of the tympanum be convex and bulging, it should be incised, as purulent matter sometimes points in that direction, and an early opening may save the patient from considerable risk.

CHRONIC PURULENT DISCHARGE FROM THE EAR.—OTORRHOEA is a condition very frequently met with. It may arise either as a result of acute otitis, or injury, as from the irritation originally produced by foreign bodies in the ear. Most generally, however, it arises in early life, as one of the sequelæ of children's diseases—measles, scarlatina, or hooping-cough. The subjects in whom we

most frequently meet with otorrhœa are of a strumous habit ; and it is always to be regarded with some anxiety, and to be carefully treated. In many cases, the diseased state on which the discharge depends is limited to the external passage, and consists in chronic ulceration of its lining membrane, and a state of mere chronic irritation of that structure. This condition may continue for years, or nearly throughout a lifetime, without producing anything more serious than dulness of hearing on that side, and the annoyance caused by the discharge. In other cases, however, the middle ear and mastoid cells are the seat of disease, and the discharge is an indication of deeply-seated mischief. It has the peculiarly foetid odour of pus generated in the neighbourhood of diseased bone, and is of variable consistence. The discharge which occurs in the otorrhœa of the external passage is generally free from fœtor, and contains a considerable amount of cuticular débris from the lining membrane.

In disease of the middle ear and mastoid cells, the discharge may continue for a long period without serious symptoms. There are, however, generally, exacerbations of deep-seated pain, tenderness, and doughy swelling over the mastoid processes, occurring from time to time ; till at last, from some slight exciting cause, such as cold, one of these exacerbations assumes a more severe and persistent form, and cerebral symptoms supervene, and terminate fatally in such circumstances. The pathological conditions found after death, such as caries of the mastoid and petrous portions of the temporal bones, disease or destruction of the dura mater, and abscess in the middle lobe of the brain, show that the disease has been long making progress towards the fatal issue.

The *Treatment* of the more superficial form of otorrhœa consists in removing all local sources of irritation, such as stumps of teeth ; correcting the state of the digestive organs, and applying locally at first weak alkaline lotions, and subsequently astringent lotions of tannin, alum, or sulphate of zinc or nitrate of silver, whilst, at the same time, blisters are applied to the nape of the neck. In the deep-seated form of disease the discharge is but a

symptom of more serious mischief. Our attention must be directed to improve the general health, and by inserting a seton in the neck or the application of the actual cautery, to try and arrest the progress of the deep caries. In cases where the textures over the mastoid process are swollen, red, and puffy, an incision should be made down upon the bone. When this is done, it not unfrequently happens that unhealthy pus escapes by the wound at the time: at other times, a thin exfoliation of bone takes place, with relief of the urgent symptoms; and, at all events, the relief of tension is followed by alleviation of the pain.

POLYPI IN THE EXTERNAL PASSAGE OF THE EAR are easily recognised, and removed by the use of small forceps, in a similar manner that we remove polypi from the nostrils. It is well to keep in mind, however, that in this situation there is peculiar soft red polypoid protrusion, which is usually connected with diseased bone, and which is rapidly reproduced after removal. It is, in fact, rather a form of polypoid granulation than a true polypus, although often assuming a regular pyriform shape. After removing such excrescences, it is well to touch the surface from whence we have removed them with red oxide of mercury, nitrate of silver, or solution of chloride of zinc, to prevent, if possible, their reproduction.

Amongst the various diseases giving rise to deafness, OBSTRUCTION OF THE EUSTACHIAN TUBE was at one time very much insisted on by specialists as a frequent cause of that infirmity, and catheterism of the tube, the eustachian air-douche, and similar operations, were very fashionable. Now, whilst obstruction of the eustachian tube undoubtedly causes imperfection in hearing, the requisite reverberation being thereby prevented, yet the causes of the obstruction are of a kind which can either be remedied by simpler measures, or in which catheterism of the tube is inapplicable. In the former class we have obstruction from swelling of the surrounding mucous membrane, or from inspiss-

sated mucus. In these conditions, catheterism of the tube would be more likely to excite irritation, and lead to organic change in structure, and so do harm rather than good. These causes of obstruction are more benefited by the inhalation of vapour, either of simple warm water, or medicated with iodine, and subsequently the free use of astringent gargles. Organic stricture of the tube is the only condition where catheterism is of benefit, and that must be a very rare condition indeed in a short mucous canal so situated as is the eustachian tube. In cases of obstruction from ulcerations of the neighbouring parts, causing contraction or obliteration of the orifice of the tube, it is needless to say that catheterism would neither be applicable nor possible. As regards the introduction of the eustachian probe, or catheter, for purposes of diagnosis, that is easily enough managed after a little practice. The instrument is made with the requisite curve, and with a flat fixed handle. The point should be very slightly bent, and the handle marked so as to indicate the direction of the point, and the distance from the orifice of the nostril to its extremity should also be calculated and marked. The instrument is passed flat along the floor of the nostril to the requisite extent; the point should be directed upwards and outwards, whilst the handle is carried towards the septum of the nostrils. These movements must be performed without any force. If effected gently, and used only for the purpose of diagnosis, no harm can result from catheterism; but if used on the pretext of dilating the tube, or to enable the aurist to use the air-douche or to inject medicated lotions, I hold such treatment to be not only useless but dangerous.

The membrane of the tympanum is often destroyed by ulceration, or ill-directed attempts to remove foreign bodies from the ear, and in consequence the hearing is lost, or at least much impaired. In such cases, when the acute action has ceased, and the ulceration is arrested, great benefit will be derived from the use of the artificial membrana tympani, originally devised by the late Mr. Toynbee. It consists of a small circle of membrane composed of very thin sheet caoutchouc, attached in the centre

to a delicate handle composed of silver wire. In using it the surgeon should first cut the membrane to adapt it to the orifice in each case, then dip it in warm water, and pass it down through the tubular ear-speculum till it reaches the orifice of the tympanum. In many cases the improvement is immediate, but of course we cannot expect benefit in those cases where the cavity of the tympanum and internal ear have suffered in their organisation from previous disease.

The artificial membrane requires to be removed almost daily to be kept clean, but the patients soon learn to do this for themselves.

SURGERY OF THE CERVICAL REGION.

LECTURE CII.

Surgery of the Neck—Cervical Tumours : Simple and Malignant—Cervical Hypertrophies, as those of the Thyroid Body : Importance of careful Diagnosis in dealing with them—Adenoid and Fibro-Cystic Parotid Tumours—Fatty Tumours of the Submaxillary Region—Diagnosis and Treatment of the different Forms of Bronchocele—M. Porta's Views.

Accidental and Suicidal Wounds in the Cervical Region : their Treatment.

THERE is no region of the body of greater interest to the surgeon than that of the neck. Besides the diseases of the various natural structures which are situated in or pass through this region, it is frequently the seat of new formations, the results of either the inflammatory process or tumour growth. The great blood-vessels and important nerves which pass through the space, their branches which traverse it in all directions, and the relations of these vital structures to abscesses or tumours forming in the neck, or their displacement or impeded function by such new formations, are subjects of the greatest importance in reference to diagnosis and operative procedure in treatment.

The nature and treatment of the wounds and other injuries in the cervical region, and especially those involving the air-passages, or the pharynx and gullet, will also demand your most serious attention, and require you to bear in mind, not merely the relative anatomy of the parts, but the functions they perform.

I have already, when lecturing on aneurism and ligature of arteries, brought under your notice the diagnosis of diseases of the arteries of the neck, and their treatment ; and, when speaking of the local dangers of suppuration, I specially drew your attention to the dangers of deep-seated abscesses in the cervical region. We have still, however, to consider the important subjects of tumours of the neck, suicidal and other wounds

occurring in this region, the injuries and affections of the air-passages requiring surgical treatment, and injuries and diseases of the pharynx and gullet.

The TUMOURS which occur in the CERVICAL REGION, whether we regard them in reference to operative surgery or diagnosis, and the question of the treatment to be adopted, are undoubtedly amongst the gravest subjects which the practical surgeon has to deal with. It is, however, impossible to do more, in a course of lectures, than to lay down some general principles, and throw out some suggestions, illustrating them by reference to special cases. The circumstances and position of tumours vary in almost every case, and consequently the surgeon in considering their character, symptoms, and treatment, must depend, in each case, on his knowledge of the anatomy and functions of the different structures in relation to, or likely to be affected by, the tumour. The tumours we meet with in the neck, besides the important division into simple and malignant, may be subdivided into those which are new developments,—true tumours, and the enlargements or hypertrophies of natural structures, such as those of the thyroid body.

Of true simple tumours those most frequently met with are the fatty, situated most generally in the submaxillary and lateral regions of the neck, and placed superficially; the fibrous and adenoid growths, occupying, usually, the parotid and deep cervical regions, and having close relations to important parts. The malignant tumours are the different forms of medullary and hard cancer.

Perhaps the most important point which the surgeon has to decide, in reference to a cervical tumour, is its nature—whether simple or malignant. If the growth be, from its history and appearance, of simple character, then, however deeply situated, or however near important structures, it is not likely to involve them; and consequently, although operations for the removal of such deep-seated tumours are perhaps the most difficult in surgery, still they may be undertaken with perfect safety and

certainty of removal of the defined growth. In deep-seated malignant tumours, on the contrary, however defined or loose they may feel, there is no real definition. They are often attached by a deep pedicle to the cervical vertebræ, and involve the deep ligamentous texture between the vertebral processes, so that complete removal is impossible, and the tumour is reproduced rapidly, and, if possible, in a worse form than at first.

In other cases of cancerous tumours, there is no definition—the mass involves all the structures in its vicinity. I have already, in lecturing on tumour-growths, specially dwelt on the characteristics of malignant, as distinguished from simple growths, and I contrasted the general appearance and expression of patients by sketches of two large cervical growths (Lecture xvii. Plate v.)

Having formed your conclusions as to the nature of the growth, and decided that it is one suited for removal, you have next to consider its relation to neighbouring important structures,—how far their functions have already been interfered with, or may be interfered with during or after the operation—then to plan your incisions so as to avoid deformity or risk to important structures, and take means to obviate hæmorrhage or the entrance of air into the enlarged veins which may require to be divided. This last is a risk that might not be thought of, and therefore I direct your attention to it, for the superficial veins over large tumours, near the lower part of the neck, become enormously enlarged, owing either to the venous circulation being interrupted by the position of the tumour, or in consequence of their having to return the blood which circulates in the growth. The fascial structures over the tumour, and connected with these veins, keep their orifices from collapsing when divided, and air might enter them and prove fatal, unless the operator take care to tie them with two ligatures before division, or to compress them with needles. In regard to details, these must vary in almost every case; but, in regard to the method of examining and dealing with large deep cervical growths, I think I will be able to illustrate that best by referring you to two cases, accounts of

which I published some years ago; and, as both were examples of the largest deep-seated and complicated forms of tumour, they may serve to indicate the chief points to be considered by the surgeon in such cases.--(See Clinical Cases.) Some surgical authorities have laid it down as a practical rule, that it is not warrantable to attempt removal of such growths when they are placed under the sterno-mastoid, as we cannot be sure of removing them entire; and that, besides the great risks of the operation, there is the risk of rapid reproduction. I think the results of the cases I have alluded to are the best warrant for operative interference in proper cases. The danger lies in attempting removal in unsuitable cases.

Removal of simple tumours from the parotid region has been so frequently performed, that I need hardly say more in reference to them than to remind you of the close relations of the portio dura nerve and the external carotid artery to such growths.

In some instances the tumour is so placed as to be superficial to the parotid gland, and then we can, by careful dissection, turn it out of its nest of condensed cellular tissue, without injuring the nerves. But in many cases the growth is developed from below, and compresses and partly adheres to the parotid, so that it is impossible to spare all the branches of the nerve. Indeed, in some instances, partial paralysis of the face is present, owing to compression of the portio dura by the growth. In a case of this kind which I operated upon last winter, the paralysis disappeared after removal of the tumour. Parotid tumours are usually fibro-cystic or adenoid, with cysts; and when the cystic element predominates, or the cysts are large, great care must be taken to avoid them in dissecting out the growth.

Fatty tumours sometimes attain an enormous size in the submaxillary region. They are quite superficial, loosely connected, and can be removed with great ease and safety, even when of the size represented in the accompanying sketch (Fig. 29).

The tumours of natural structures met with in the neck are chiefly those of the Thyroid Body, constituting the different forms of Bronchocele. This disease may exist as a simple

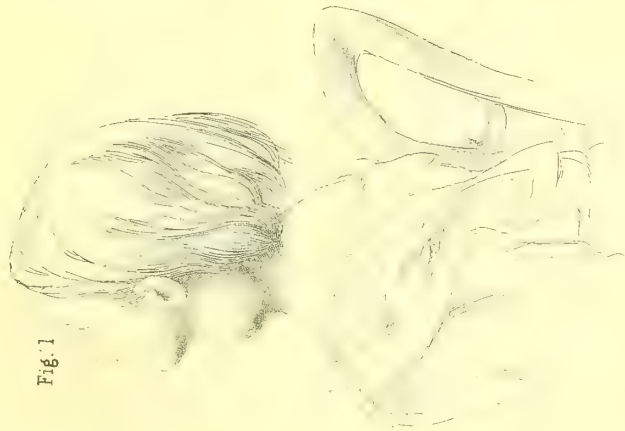


Fig. 1



Fig. 2



Fig. 3



hypertrophy of the gland, due to increased nutrition of its structure, the whole organ being enlarged, but its form and



Fig. 29.

structure unaltered ; or it may be highly vascular, so as to have a character almost erectile, and communicating a strong pulsatory feeling to the touch. The conditions just mentioned may be confined to a part of the gland, which enlarges, whilst the rest of the organ remains of its natural size, or is but little altered. In such partial enlargements, when the isthmus is developed as a growth, it often interferes with respiration ; and when the erectile form of enlargement is confined to one lateral lobe, it has occasionally been mistaken for carotid aneurism. Cystic tumour of the thyroid is another form, and the cystic tumour may either be multilocular or a large single cyst. In the latter case the contents consist of either a clear serous-looking fluid, constituting hydrocele of the thyroid ; or fluid of a dark brown colour, mixed with clots of blood, constituting hæmatocele of the thyroid. In these cystic tumours the swelling is almost

invariably confined to one lateral lobe, or to a cystic projection of the isthmus.

In either the solid or cystic bronchocele, the position and general form of the swelling, together with its connection with the trachea, are in general sufficient to decide our diagnosis. If the patient be made to swallow repeatedly a little fluid slowly, the way in which the tumour ascends and descends synchronously with the movements of the larynx and trachea, can leave us in little doubt as to its nature and relations. There are, however, tumours developed from or connected with the thyroid body, which occupy a position apparently quite away from it, and which are not very distinctly affected by the movements of the trachea during deglutition. These tumours, apparently superficial at their most prominent part, might lead to some confusion to the operator in removing them, unless he were prepared to find that they are always deep-seated over the sheath of the vessels, and that instead of being defined and rounded, as their external appearance would indicate, they are rather pyriform, the narrow part being attached below to the lateral lobe of the thyroid. Hence they are not much affected by the movements of the rest of the gland,—yet by attentive examination they will be felt to move in such a way as to make us suspect the true connections. I have removed two large growths of this kind, and the external appearances of one of them are represented in Plate xlvii. Fig. 1.

The more solid forms of bronchocele, or goitre, are comparatively common, and in some mountainous countries and in certain districts of England the disease seems to be endemic. In many instances the thyroid enlargement attains a great size without materially affecting the functions of respiration and deglutition, although, I think, invariably affecting the general health, for such patients are usually anæmic, with prominent eyeballs and weak circulation. In other cases the embarrassment of the breathing is very great, and in some cases necessitates the performance of tracheotomy. In the cystic form, which often attains an enormous size, the air-passages are displaced laterally,

and a sudden increase may threaten suffocation, as happened to a patient under my care, a notice of which will be found in the Clinical Cases.

The *Treatment* of the solid or vascular forms of bronchocele must consist chiefly in the use of discutient remedies, exhibited both externally and internally, such as blisters applied over the swelling, followed by painting the surface with tincture of iodine, and the internal use of the iodide of potassium, continued for a length of time. Under this treatment the swelling gradually, in some cases rapidly, diminishes, and a cure is effected. Various plans for excision of the thyroid body, or ligature of all the thyroid arteries, have been proposed, but attempts to put them in practice have hitherto failed. Partial excisions, as in the case of the projecting tumours of the isthmus, have been successfully performed. In performing this operation, a free incision is made in the central line of the neck, the cellular tissue connecting the sterno-hyoid and thyroid muscle is divided, and these muscles separated with the point of the finger, and held aside, so as to display the tumour. After insulating it so far, its pedicle should be transfixed with a needle armed with a double ligature, so as to embrace each half of it in a ligature. When the ligatures are firmly tied, the projecting mass of the tumour is cut off. In one case, in dissecting out a tumour in this position, after detaching it with very little bleeding, I unwarily divided the small remaining portion, when profuse hæmorrhage took place from a vessel in the position of the middle thyroid; and, as it retracted toward the substernal region, it was very difficult to secure. A single ligature applied before division would have saved all the trouble. In excising the growths less directly connected with the lateral lobes of the thyroid, to which I have alluded, the principles of the operative procedure are the same as for removal of deep-seated tumours of the neck, keeping in mind our close proximity to the great vessels of the region and their branches, and also to the superior laryngeal nerve. But when the operator reaches the point of attachment to the thyroid, the best plan is to transfix and tie the immediately adjacent part

of the gland before removing the tumour. In the case of the young girl, from whom the sketch in Plate xlvii. is taken, I found the tumour so apparently defined, that I dissected it out; but, in reality, the texture of the thyroid, although somewhat condensed, had been cut, and I had to twist and tie a number of bleeding points out of all proportion to the size of the cut surface. In operating on a similar case in an adult female, I transfixed and deligated the substance of the thyroid before removing the tumour, and there was no trouble in securing vessels.

The *Treatment* of cystic bronchocele will depend on whether it be a single or multilocular cystic tumour: in the former case we merely require to tap the cyst, and inject tincture of iodine, to cause its obliteration and cure. In some very large cysts we require to make an opening and counter-opening to evacuate the cyst fully, and then with a large camel-hair pencil paint the interior with tincture of iodine. In making counter-openings in such cases we require to use due caution, as the cyst underlies the sterno-mastoid, and its pressure may have displaced important parts towards the surface; but if we make a cautious examination before puncturing the cyst there is no danger. If the cyst contain dark-brown fluid, showing it to be a hæmatocele, and if the contents be homogeneous, the same treatment as for simple hydrocele will be sufficient; but if there be clots, or, if after the fluid has been removed, the bulk of the cyst is not much diminished, the aperture made by the trocar should be enlarged, so as to admit the finger, and if it be filled with coagula, the incision should be still further enlarged, the clots turned out, and the interior painted with iodine, or with tincture of matico if there is any oozing of blood. In operating on a case of this kind on one occasion, after turning out the coagula, there was no oozing of blood at the time, but shortly afterwards smart oozing occurred, and I required to stuff the cavity with lint, dipped in a weak solution of perchloride of iron, to arrest it. Bleeding recurred about ten days afterwards, but was easily arrested by cold, and the girl made a good recovery; but I have known a case in which un-

controllable bleeding following an operation on a hæmatocele of the thyroid proved fatal. I do not, however, think perchloride of iron a very safe styptic in such a vascular organ, lest embolism or thrombosis take place, in consequence of small clots being carried into the circulation.

M. Porta has proposed that in multilocular cysts, and even some more solid forms of thyroid tumours, we should enucleate cysts or portions of the structure by making incisions into the gland. He founds his plan on the ground that the great vessels of the thyroid body ramify on its surface, not in the interior, and that if we avoid these large vessels the enucleations can be effected without risk of hæmorrhage. I cannot, however, with the recollection of what I have seen in operations for hæmatocele of the thyroid, recommend this method as free from the danger of bleeding. It is quite true that the main vascular trunks principally ramify on the surface of the gland, but their minute ramifications are in the interior, and constitute an almost erectile tissue in the interstices of the cell portion of the gland, and it is from this texture that the risk of hæmorrhage occurs. In ordinary solid tumours the discutient plan is safer.

WOUNDS IN THE CERVICAL REGION, implicating the Throat, Œsophagus, and Air-passages, are of great importance. They may be either accidental or suicidal. The latter are generally transverse, as the suicide endeavours to cut into the air-passages. In this he generally fails, by stretching his neck, and so cutting above the larynx, while he seldom or never divides the great blood-vessels. I have seen, however, a wound of the jugular, whilst the carotid was intact; and, on the other hand, I have tied the carotid for a small wound in its walls. The branches of the lingual, facial, and thyroid arteries are generally cut, while, as I said before, the main trunks are rarely injured. The lingual artery itself is seldom divided. The wound has a frightful look, large and gaping, it stretches from side to side, and there is a gurgling of air and venous blood. Bleeding must be arrested at once. The sides of the wound being compressed by the fingers, it

should be cleaned of clots and mucus, so as to obtain a view of the parts. The arteries, however small, if wounded, should be ligatured, and the bleeding veins secured either by ligature or compression. The common custom of sewing the wound is most reprehensible. The deep-seated textures cannot be expected to heal by the first intention, from the necessary movements of the parts. Mucus and blood and air get into the deeper-seated parts of the wound when it is sewn up, and lead to emphysema and unhealthy action. Purulent matter infiltrates and distends the tissues, so that the patient speedily dies from suffocation. Even when the wound does not pass so deeply, it should not be stitched, as blood or pus is certain to accumulate and complicate recovery. In all cases, therefore, while we may sew the angles, the centre of the wound should be left open. We must, however, take means to prevent the edges of the skin becoming inverted during the healing process.

The patient's mental and physical condition materially influences the progress of cure, and often complicates the treatment of the case, and the patient often dies, even when the wound is all but healed. Should the pharynx or œsophagus be wounded, it is necessary to nourish the patient by a tube passed through the nostrils. The instrument, however, should be passed as seldom as possible, because in the wounded state of the pharynx its introduction is difficult, while there is a danger, during the struggles of the patient, of its passing into the posterior mediastinum. When it is impossible to pass the instrument by the nostril, the patient must be fed by passing the tube by the mouth or by the wound itself. The latter, if possible, must be avoided, as it keeps the wound open and causes great irritation.

Suicidal wounds, leading to inflammation and œdema glottidis, often require tracheotomy. The operation is peculiarly difficult, as the larynx is dragged downwards to the sternum, while, by stretching the head and neck backwards we gain no advantage, we only make the wound gape more widely. The upper part of the larynx should therefore be fixed with a sharp hook, and drawn upwards and forwards, as nearly as

possible into its natural position, before proceeding with the operation.

The general after-treatment must be determined by the particular symptoms and conditions of the patient in each case. The general indications are to allay irritability and procure sleep by the exhibition of opiates, and large doses of bromide of potassium, whilst, at the same time, the nutrition of the patient is maintained.

LECTURE CIII.

Injuries of the Larynx—Circumstances which regulate their Severity—Primary and Secondary Dangers—Foreign Bodies in Larynx—Variety and Intensity of accompanying Symptoms, as regulated by character of Impacted Body—Sensibility of different parts of the Mucous Surface—Illustrative Cases—Tracheotomy—Special Hints regarding the Administration of Chloroform in the Operation—After-Treatment of Wound—Other Methods of causing the Ejection of Foreign Bodies—Accidents arising from the swallowing of Boiling or Acrid Fluids.

WE now pass on to the consideration of INJURIES AND DISEASES OF THE AIR-PASSAGES. As these are of great importance, requiring prompt and decided surgical interference, the student should make himself familiar with all their details, and especially with those circumstances which indicate the necessity of having recourse to the operations of tracheotomy or laryngotomy.

We shall first treat of *Injuries* of the air-passages.

Injuries of the larynx are of different kinds, and may arise from blows, or from falls upon the box of the larynx, or from compression, as in manual strangulation. In young subjects the cartilages of the larynx are very soft and pliable; and whilst they may, by direct violence, be pressed against each other, for a time, so as to prevent breathing, still their natural elasticity causes the parts to regain their normal form immediately after the pressure has been removed. In persons beyond middle life, however, the cartilages are strong and resistant, possessing both elasticity and absolute strength, so that they are not easily compressed by direct force. The cases where there is most risk of injury to the larynx are either those of young subjects, for the reason stated, or those of persons rather advanced in life, where the cartilages are beginning to undergo ossification. When the cartilages are completely ossified they acquire a certain amount of resistance, and are not likely to yield to an ordinary degree of force; but

Fig 1

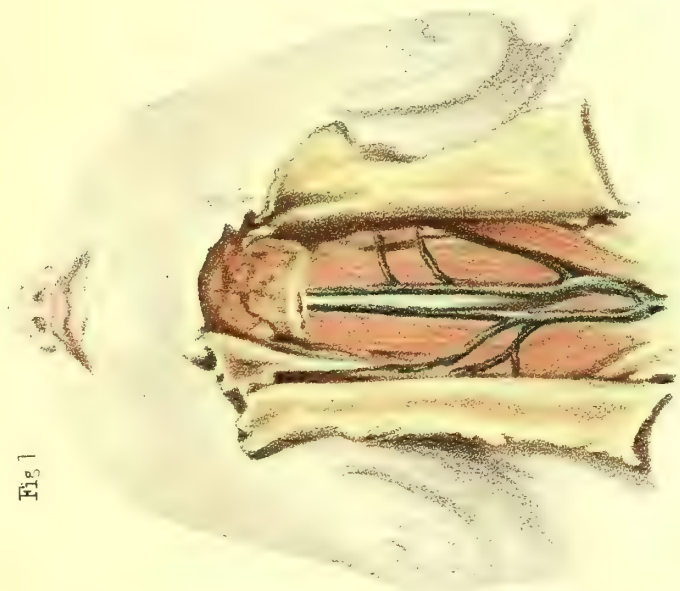
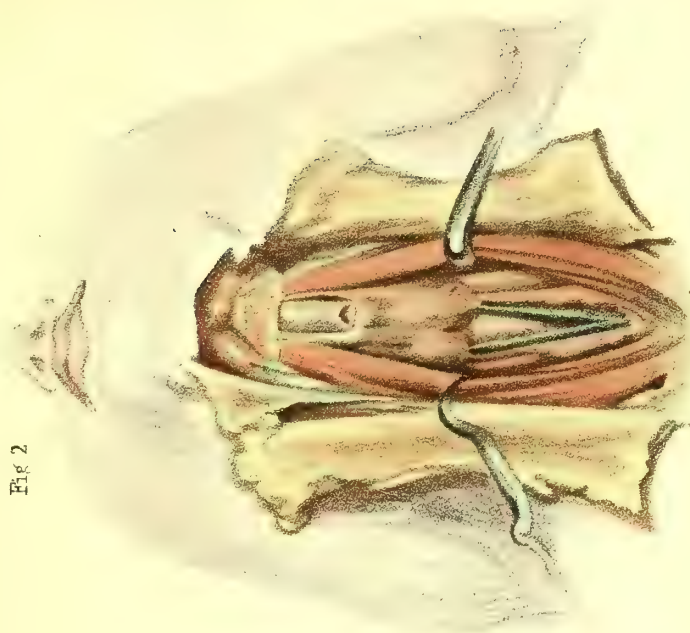


Fig 2





when they are beginning to undergo that change they are of an irregular consistence, and therefore yield unequally. In the latter condition a blow, or pressure with the hand, as in manual strangulation, may give rise to fracture—by causing separation of the fibro-cartilaginous from the ossified portion—and so lead to obstruction of the passage from altered form, or from bruising and inflammation on the internal lining membrane. This interferes with respiration, and frequently causes such alteration in the part as to require an opening to be made below the injured point.

The dangers arising from injuries of the larynx are therefore either primary or secondary. The primary danger is that of immediate suffocation, which may arise from the absolute crushing of the cartilages, this being most easily accomplished in young subjects where they are soft and pliable. The secondary danger may arise from bruising of the larynx. This may occur at almost any period of life ; and though there may be no positive alteration in external form, the parts may be much bruised and injured internally ; in such cases effusion of blood takes place into the submucous tissue, between the mucous membrane of the larynx and the cartilages ; or inflammatory exudation may come on in a few hours after the receipt of the injury ; and, in either case, the respiration becomes so seriously impeded as to render it necessary for the surgeon to perform the operation of tracheotomy. If we delay, œdema glottidis may rapidly supervene and suffocate the patient, or he may be carried off by a spasmodic closure of the glottis, produced by irritation of the laryngeal nerves. In all cases of injury or disease of the larynx, the presence of irritation of any kind, and the liability to spasm which attends it, are circumstances to be taken into account, for the glottis is an accurately adapted valvular arrangement, and, under such circumstances, spasm of the laryngeal muscles superadded, very readily produces suffocation. If we should see the case in time, we may do something to avert the dangers of spasm and inflammation, by the administration of ipecacuan, opium, and the inhalation of steam, or the external application of fomentations to the larynx.

The ENTRANCE OF FOREIGN BODIES into the larynx is a very dangerous form of accident, and one of frequent occurrence. The danger is not always in direct proportion to the bulk of the body introduced. The symptoms are very marked in the earlier stages. They are, in fact, an exaggeration of those produced by what in popular language is spoken of as a piece of food "going down the wrong way"—namely, a violent convulsive cough, immediately followed by a sense of suffocation, and a strong effort of the patient to bring all the muscles of the larynx and chest into play, so as to expel the offending substance. If the patient succeeds in doing this, the symptoms, of course, cease, but they may also pass off for a time without the danger being removed. A foreign body, such as a cherry-stone, may enter the larynx and give rise to a great deal of irritation and violent symptoms of suffocation; but if it pass down into the trachea, and thence into the bronchus, these symptoms will cease, and a period of quiescence come on, during which the patient breathes quite easily, and yet the danger has not passed away. The foreign body is still present, and when the patient begins to cough or move about, it may again be thrown up into the larynx. All the symptoms immediately return, and during one of the paroxysms the patient may be suffocated. The foreign body may even remain in the larynx itself, and yet no symptoms show themselves for a time. In one case, when examining a body, I found an orange-pip, which lay in the ventricle of Morgagni, and remained there for years, but it ultimately caused the death of the patient, for, though it produced no irritation at first, and though its presence was not suspected, it was the means of setting up disease in the larynx, which terminated in a form of Phthisis Laryngea.

When we look at the physiological conditions which give rise to the symptoms, we see how important they are as regards the diagnosis. The upper parts of the air-passages are endowed with a peculiar form of innervation, their mucous membrane being supplied entirely by the superior laryngeal nerve, the filaments of which pass down for some distance.

The mucous membrane of the trachea and bronchi, on the other hand, is supplied by other branches from the vagus, which are given off lower down, and is not by any means so sensitive. The sensitive part of the mucous membrane begins at the lower surface of the epiglottis. This valve is so constructed that during deglutition its upper surface must come in contact with the food, often more or less stimulating in character, yet no irritation is produced by this in general. But let a single drop of water touch the *lower* surface of the epiglottis or mucous membrane of the glottis, and we have all the violent symptoms described above. This contrast in the sensibility of the two surfaces is explained by the difference in the nervous supply; for, whilst the upper part is supplied by branches from the glosso-pharyngeal, a nerve of the tongue, the lower surface derives its supply from the superior laryngeal, which, as already stated, is the proper sentient nerve of the larynx.

The laryngeal nerve is endowed with extreme sensibility, and acts as a sentinel to protect the air-passages from the entrance of any foreign body. Lower down the mucous membrane becomes much less irritable. If we pass a probe into the bronchi, it gives rise to some irritation, but not to the suffocating convulsive cough which is produced by touching the larynx. This is due to the difference in the innervation of the two parts, and hence we see how a foreign body, getting into the air-passages, may at first irritate the peculiar mucous membrane of the larynx, producing spasm and suffocating paroxysms; and yet, presently, we may have a period of quiescence, owing to its having dropped from the larynx into the trachea or bronchus. The following cases will illustrate these principles:—

I was called many years ago to see a girl who had, at the same time, swallowed a cherry-stone and a plum-stone. Violent symptoms had occurred after swallowing them. A young medical man saw her at the time, and from his description I had no doubt that the stones had passed into the air-passages. When I arrived the girl was perfectly quiet, though breathing in a peculiar way, but the mother said she had always breathed

so. This statement rendered the case rather doubtful ; but the difficulty was still further increased by another circumstance, namely, that during one of the violent paroxysms the girl had coughed up the plum-stone, which might apparently have produced all the symptoms. Fearing, however, that the cherry-stone might also have found its way into the air-passage and be still unexpelled, I suspended her with the head downwards, and shook her, so as to make it drop out if possible, but this produced no effect. There remained no difficulty of breathing, but, taking all the circumstances into account, I thought it prudent to have her removed to the hospital, where she might be carefully watched. I saw her two or three times during the evening, but she was still quite quiet, and remained so all night. Next day, however, at visit she was seized with a violent paroxysm. I immediately performed tracheotomy, and the cherry-stone was ejected through the wound.

The following case may form a contrast :—A little child about a year old was brought into the hospital. She had been playing with some peas, and was supposed to have swallowed some of them. On admission, the child was quite quiet, and there was nothing apparently the matter with her, and it is worthy of remark that, neither in this nor in the preceding case, could we hear the peculiar valvular sound sometimes produced by a loose body lying in the air-passages. Tracheotomy was therefore not performed at the time, but she was carefully watched in the hospital for some days, and while there passed a few peas by stool. The mother then insisted on taking her home, thinking she was quite sure that all the peas had been evacuated ; but on the very night of her removal the child died from sudden suffocation. A pea had become lodged in the air-passage, and had produced no irritation, until, in the process of swelling by the moisture, it had split into two halves, when a cough or expulsive effort had forced one of the halves into the larynx, and so induced fatal spasm. Now, in this case, had the child been left in hospital, tracheotomy could have been performed at once, and her life would in all probability have been saved.

I have seen many more cases in point, and from what I have seen, I consider that when there is any doubt, the safest plan—if there be a good history of the case and reliable symptoms—is to perform tracheotomy as soon as possible. Opening the trachea in these circumstances is not in itself a dangerous operation, and it may be the means of saving life.

The foreign body may be either loose or impacted. When it is a portion of food that causes the symptoms of suffocation, it generally stops at the top of the air-passages, and does not pass downwards.* We should therefore always examine the back part of the mouth with the finger, so as to detect the presence of the mass, and remove it at once. It is generally stated that foreign bodies, passing downwards from the larynx, naturally find their way into the right bronchus. Now the right bronchus is certainly larger than the left, but its communication with the trachea is not more direct; and, in my experience of cases, where the exact position of the foreign body could be ascertained, I have found it has always been in the left bronchus. In one case—that of a little girl—while I was performing tracheotomy, the foreign body was loose, but the expulsive effort ceased just as the plum-stone appeared at the opening, and it slipped down the left bronchus, impacting itself so far down that it could not be extracted. A tube was inserted as usual into the throat, but the child was suffering from pneumonia, especially in the right lung, and died shortly afterwards.

In another case, a child was said to have swallowed a plum-stone; but no symptoms came on till the next morning, when the patient was seized with a violent paroxysmal cough. When I saw the child it was cold and moribund. I opened the trachea at once, and introduced a tube, and then the respiration became normal, and the patient began to recover; but the foreign body was evidently not expelled, though we could not discover it, for on closing the tracheal opening for a moment the difficult breathing at once returned. Bronchitis in this case soon came on, and the child died. At the *post-mortem* we found, in one of

* There may be exceptions to this—(see Clinical Cases).

the subdivisions of the left bronchus, a very small plum-stone firmly impacted. The symptoms here must have been due to the reflex action of the nerves causing spasm of the glottis, for, even to the last, whenever the opening was closed, the difficult respiration was re-established. In another case, that of a man, tracheotomy had been performed, and for some reason the tube was kept permanently in. One day, when he was riding out, the shield of the tube had fallen off, and, according to the man's own account, the tube had passed into the larynx. On examining his throat I detected it in the left bronchus. He was therefore put under chloroform, by holding a handkerchief to the opening in the trachea, and the tube was extracted by means of a pair of pharynx forceps, the closed blades of which were introduced into the bronchus, and inserted into the open mouth of the tube ; the blades were then opened so as to hold the tube firmly during its withdrawal.

In performing tracheotomy for loose foreign bodies, some special points are to be attended to, not only as to the mode of operating, but as to the use of chloroform. If a foreign body be lying loose in the trachea, and if we expect it to be ejected by the natural expulsive efforts when the tracheal opening is made, we should give no chloroform. In the case of the girl mentioned in the preceding page, for example, I believe the expulsive efforts of nature would have forced out the foreign body had chloroform not been previously administered. In cases of impacted foreign bodies, on the other hand, where we require to use instruments for their extraction, and where the introduction of the instruments necessarily causes a great deal of irritation and convulsive cough, chloroform is of very great service, for it quiets the patient, and greatly increases the chances of success. In cases of a doubtful kind, as where a small coin or a large plum-stone has been swallowed, and may be impacted, though we hope it is not, I think we should perform the early part of the operation of tracheotomy without chloroform. If we find afterwards that the foreign body is not expelled by the natural efforts of the patient, but is impacted in the air-passages, then we may give the patient chloroform, and

enlarge the opening so as to enable us to use instruments for its extraction.

Instead of using forceps, as was formerly done, for the purpose of holding aside the edges of the wound in performing tracheotomy, I use the flat ivory handle of the scalpel to separate the edges, and so afford a smooth surface to allow the foreign body to escape. Another point, and one about which little or nothing is said in surgical works, is the after-treatment of the wound in such cases of tracheotomy. We should not treat the wound with the view of closing it immediately, for if we bring the edges together by plaster or by sutures, the patient might be suffocated in a very few hours. The air, in such circumstances, would escape from the opening in the trachea into the loose cellular tissue of the neck, and as it would be unable to make its exit by the superficial wound, emphysema of the neck would come on, and might cause the patient's death by suffocation. In all cases, therefore, after the extraction of a foreign body, we should introduce a tracheotomy-tube into the trachea, and keep it there for from four to six hours, till lymph be effused and the wound become glazed. Not till then should the tube be withdrawn, and even then it is safer not to close the wound by sutures, but merely by slips of plaster, or it should be left to heal by secondary union.

There are other methods which have been proposed for causing the ejection of loose foreign bodies. When an individual, for example, in pretending to swallow a coin and bring it up again, allows it to get into the air-passages, it may sometimes be made to fall out if the patient be inverted and shaken; but in doing this we must always be ready to perform tracheotomy at the time. If the coin be a pretty large one, such as a shilling, it may be made to fall out by inverting and shaking the patient, because such a coin could scarcely go down into the larynx; but with a smaller coin, or such a body as a cherry-stone, the danger is greater, for smaller bodies are likely to pass lower down. When the patient is first seen, a body of this kind may be lying in the trachea or bronchus, where, as already explained, it may be producing little or no irritation;

but should he be inverted and shaken, it may roll downwards, so as to impinge upon the sensitive mucous membrane of the larynx, and it is then very likely to give rise to dangerous suffocative spasm of the glottis. The surgeon should, therefore, never have recourse to inversion without having previously prepared himself for the immediate performance of tracheotomy in the event of dangerous spasm.

Some of the most formidable injuries of the air-passages are caused by ACCIDENTS ARISING FROM THE SWALLOWING OF BOILING OR ACRID FLUIDS.—The immediate effect of swallowing boiling water is to produce great swelling and inflammation about the upper part of the glottis—in fact, a form of acute cedema glottidis. Under such circumstances the upper part of the larynx is rapidly closed, and suffocation will ensue unless tracheotomy be speedily performed. So far as the breathing is concerned, this will afford complete relief. Subsequently, however, the inflammatory action may extend to the bronchial tubes and give rise to bronchitis, or the injury may so seriously affect the pharynx and œsophagus, as to interfere greatly with deglutition. The case may then terminate fatally some days after the operation, but many cases are saved ; and the surgeon's duty is therefore to perform tracheotomy early, whenever the symptoms of approaching suffocation begin to appear.

I do not recollect any instance, in my own practice, in which tracheotomy was required in consequence of cedema glottidis supervening upon acrid fluids, such as acids, being swallowed by adults or children, either intentionally or accidentally ; but such a result has occurred, and we must therefore be prepared for it. The effect of sulphuric acid on the mucous membrane of the fauces and pharynx is to whiten and corrugate it, leading to its ultimate desquamation. It has not apparently the same tendency to produce swelling as when steam or boiling water is inhaled or swallowed, but if in any exceptional case symptoms of suffocation should come on, tracheotomy must be performed without delay.

LECTURE CIV.

Œdema Glottidis : its Nature and Treatment—Croup and Acute Laryngitis : Similarity of their Symptoms—Pathological Changes in the different Stages of Croup—The Physical Manifestations which accompany them—Treatment, Medical and Surgical—Indications and Arguments for and against Tracheotomy—The Proper Time for performing it.

THE DISEASES OF THE AIR-PASSAGES may be classified under the two heads of Acute and Chronic. The acute forms include Œdema Glottidis, Acute Laryngitis, and Croup or Cynanche Trachealis.

ŒDEMA GLOTTIDIS, as its name implies, consists of an enlargement or swelling of the textures around the glottis, arising from infiltration of serum or sero-purulent matter into its submucous tissue. It is rather the result of various kinds of diseased action than a special disease. It may arise, in cases of Bright's disease, from sudden dropsical effusion into the soft textures about the glottis, or it may occur after cynanche laryngea, from effusion of serum into the loose cellular tissue about the larynx. Œdema glottidis may also come on after tonsillitis or scarlatina ; it not unfrequently follows erysipelas ; and is not by any means rare as a result of local irritation arising from mechanical or potential irritants. Thus, the accidental swallowing of foreign bodies, or of the mineral acids, or of boiling water, may give rise to it. In fact, any inflammatory affection of the larynx, tongue, or other parts in the neighbourhood, may be followed by œdema glottidis. The obstruction to

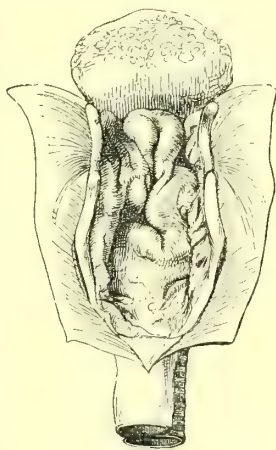


Fig. 30.

the entrance of air into the lungs which it gives rise to is entirely of a mechanical nature, being the consequence of swelling at the entrance of the air-passages. Therefore, if milder treatment fails, there can be no doubt as to the propriety of at once performing an operation such as laryngotomy or tracheotomy, which will afford complete relief to the breathing.

As regards the diagnostic symptoms of oedema glottidis, there is great dyspnoea, affecting the act of expiration, after a time, as well as that of inspiration, and this apart from any disease of the chest. There are hoarseness, difficulty of articulation, and sometimes complete aphonia. On examination, by means of the finger, we feel the epiglottis standing erect, and when we depress the tongue with a spatula we can even see it. The uvula and fauces are often oedematous. The diagnosis can be confirmed, if necessary, by means of the laryngoscope.

The *Treatment*, in order to be of any avail, must be prompt. In the earlier stages of the attack it has been proposed to make shallow scarifications in the uvula, epiglottis, tonsils, and surrounding textures. There is seldom, however, any time to be lost in performing these minor operations, though sometimes, at the first approach of the attack, we may snip off the uvula, and so prevent the occurrence of serious symptoms; but when the disease has fairly set in, we should open the trachea without delay.

The INFLAMMATORY AFFECTIONS of the larynx and trachea arise, in many cases, from exposure to cold and wet, and they are accordingly most prevalent in very cold, or in damp and foggy weather. These diseases, both in their acute and chronic forms, are most common in those liable to sudden changes of temperature, such, for example, as gardeners, who are employed in hot-houses.

In children we meet with a peculiar form of laryngitis—namely, CROUP—which, in this manner, often arises from exposure to cold and damp. The general symptoms of acute laryngitis and croup are very much alike, and we may therefore with

advantage consider them together. There is pain in the larynx and trachea, aggravated by pressure, or by attempts at swallowing, which may lead to a sense of suffocation at the time. In general there is a good deal of cough; and in croup we have a peculiar kind of cough, with a hard ringing metallic or "brassy" sound. There is always a considerable degree of fever, and the child is restless and tosses about. The tone of voice in all cases becomes hoarse, whether in the adult or child, and sometimes there is complete aphonia. Respiration is accompanied with a peculiar stridulous sound, which becomes more marked as the disease progresses. After a time there is a suffocating cough, which comes on in paroxysms. In cases where the disease is in its advanced stage, the respiration is very peculiar, and consists of a prolonged slow inspiration, with great depression of the supra-sternal fossa, followed by a short, rapid, and forcible expiration—the inspiration being accompanied with a peculiar stridulous sound. This is accounted for by the textures at the upper part of the glottis being swollen and inflamed. The movements of the glottis consequently induce spasm of the muscles, so that the passage is still further narrowed, and the air enters with difficulty. In addition to this, the mucous surfaces are roughened by the inflammatory exudation, and hence the peculiar inspiration. The expiration is short, because the expiratory muscles act violently, and the quantity of air in the lungs not being equal generally to the normal standard, its expulsion takes place with the greater rapidity. In cedema glottidis we have, after a time, a mechanical obstruction to the expiration as well as to the inspiration; but, in the earlier stages of this disease, we have the peculiar prolonged inspiration, with a stridulous noise, and the short and rapid expiration, as in croup or laryngitis.

In croup an exudation of lymph, either in a granular form or as a false membrane, is formed upon the mucous surface of the trachea as well as that of the larynx, and this distinguishes the disease from simple laryngitis. The false membrane has a great tendency to extend along the air-passages, so as sometimes to produce a complete tubular cast of the trachea and bronchi. In

other cases it confines itself almost exclusively to the larynx. It may be loosely attached, or it may tend to become loose at certain points.

The formation of this layer marks the occurrence of the second stage in croup.

In the second stage of croup, therefore, when the false membrane has begun to form, we have frequently another physical symptom present—namely, a valvular sound heard immediately after expiration. This is caused by a loosened edge of the false membrane being raised by the air in expiration, and flapping down again upon the lining membrane after the air has passed out. When the tube of false membrane forms a complete cast, or when it is adherent throughout its extent, this symptom is of course wanting. From the circumstance that in croup the false membrane extends more or less into the trachea, the term *Cynanche trachealis* has been applied to the disease, but, as I will explain presently, I think this an unfortunate name, as it is apt to mislead in certain respects. In both croup and laryngitis there is a tendency to cerebral congestion and coma, owing to the imperfect aëration of the blood.

In the LARYNGITIS of adults the diseased action is generally limited to the larynx; and, though it is sometimes attended with double bronchitis, it does not tend to produce a false membrane. In some cases, however, small abscesses form in the submucous cellular tissue, or small patches of lymph are effused. The inflammatory action rarely passes into the trachea.

In the early stages, both of croup and laryngitis, the stridulous breathing, and the suffocating paroxysms of cough, are chiefly dependent on irritation of the mucous membrane, exciting the muscles to spasmodic action, so that, combined with the swelling of the mucous membrane—even before that swelling gives rise to any obstruction to the respiration—there may be obstructed respiration from spasm of the glottis, and this of itself may necessitate an operation, for the paroxysms are often so violent as to threaten suffocation. This may arise long before

the mere mechanical obstruction has progressed so far as to warrant the performance of an operation. In most cases, then, we have, superadded to the inflammatory swelling, the irritation and danger produced by such spasms.

During the earlier stages of laryngitis in adults, and of croup in children, a good deal can be done, by active *Medical Treatment*, to avert or postpone these misfortunes. General depletion will often mitigate the severity of the symptoms to a very great extent, relieving not only the local congestion, but rendering the respiration much more free by its powerful antispasmodic effects. In cases of croup, blood-letting is best accomplished by opening the external jugular vein. The use of the vapour, hot-air, or warm-water bath, is also very beneficial. A good plan, both for adults and children, is to manufacture a sort of vapour bath, by rolling up heated bricks, in blankets which have been wrung out of hot water, for the steam and heat so produced will make vapour form in the room or bed, and cause the patient to perspire very freely. The breathing will thus in many cases be greatly relieved. The use of other remedies also, such as mercurials, to prevent deposition or cause absorption of the lymph, acts beneficially. To allay the irritation which causes the spasms, we may give opiates cautiously, along with antimony. Sinapisms also may be applied on the chest or between the shoulders, or a blister well down upon the chest; but never apply a blister in front of the neck in such cases, as it will do no good; and if tracheotomy is required afterwards, it will have to be done under much less favourable circumstances. An excellent plan of treatment, in most cases, is to steam the room or bed by some such means as those already described, and to keep sponges, wrung out of hot water, constantly applied over the larynx, administering internally at the same time full doses of ipecacuanha wine, so as to keep up a degree of constant nausea.

If all these means fail, we must then adopt *Surgical Treatment*, properly so called. In acute laryngitis, where the suffocating paroxysms are becoming more constant; when the

cough is becoming, perhaps, suppressed, but the tendency is still present ; where there is congestion of the face, and of the veins of the neck ; where the chest does not distend fully and freely during inspiration ; or where, instead of congestion of the face and neck, we have a pale condition of the face, with blue lips, and a slow, irregular pulse ;—then the sooner tracheotomy is performed the better. The blood is not being aerated properly, and we should, therefore, immediately make an opening in the trachea lower down than the obstruction, whatever that obstruction be caused by, provided the medical remedies before mentioned have been tried and have failed. In laryngitis we have no hesitation in operating, because the disease is limited and has no tendency to spread downwards. Whatever may be said about the propriety of performing tracheotomy in croup, no difference of opinion exists as to the necessity for the operation in the laryngitis of adults.

In croup, on the contrary, there are conditions which have given rise to a difference of opinion. There is here, as already remarked, a tendency in the diseased condition to spread downwards, and we are therefore told that it is not disease of the larynx, but *cynanche trachealis*. Now this is just a case where the name of the disease influences its treatment. *Cynanche Trachealis* is a name chosen as a sort of distinction between croup and the laryngitis of adults, from the tendency to the formation of a false membrane in croup as opposed to laryngitis ; but it does not follow from this that the disease is not originally a disease of the larynx. I am quite convinced, from what I have seen of this disease, that it really commences in all cases in the larynx ; and I have no hesitation in saying this, whatever tendency there may be for the disease to spread downwards from the larynx. The symptoms of laryngitis and of croup are exactly the same ; there is the same suffocating cough, the same difficult respiration, the same tenderness over the larynx ; and all the symptoms point to the larynx being affected from the very first. I feel convinced that in many cases of croup the disease is more confined to the larynx than is gene-

rally supposed, and that, when it spreads, it does so from the larynx downwards, and does not attack the mucous membrane of the trachea simultaneously with that of the larynx, or—as some would have us believe—attack the trachea and bronchial mucous surface before affecting the larynx. Post-mortem examinations reveal to us the completed disease, not its progress : our knowledge of that must be derived from observation of phenomena during life. Now, to say nothing of the ordinary progress of the symptoms, the immediate relief afforded by the operation in all my cases, even in those which subsequently terminated fatally, shows conclusively that even in the fatal cases no disease of the lower part of the trachea could have existed at the time, otherwise the operation could not have afforded the relief it did. As to the presence of bronchitis being a contra-indication to the performance of the operation, a point which I was inclined to insist on formerly—though I would not go so far as some continental surgeons, who consider it absolutely favourable—I must modify my former opinion, inasmuch as in most of the successful cases it was present, and when the tube was properly managed the mucus was easily expectorated. Perhaps it may be considered favourable in one sense, as indicating a condition of the mucous membrane less predisposed to the formation of plastic exudations.

As regards the propriety of performing tracheotomy in extreme cases of croup, I have operated now ninety-one times in simple and diphtheritic croup, and my present average is one life saved out of three cases, which is a large average in such a disease ; and I therefore feel that the operation is perfectly warrantable, and ought to be performed, as it gives the patient his only chance of life.

Another point, which has been discussed principally on the Continent, has reference to the propriety of operating at an early stage of croup. It has been stated that the operation would be much more favourable if performed before the symptoms became urgent. M. Trousseau and those who hold this view say that the operation should be performed before or early in the second stage,

before the false membrane has formed. Now, recoveries by the use of other remedies at this stage, though rare, are not so rare as to entitle us to urge an operation not free from danger in itself, unless we are prepared to show some good grounds for believing that by early operation we could greatly increase the chances of success:—1st, By early relief of the dyspnœa preventing the bad effects of the gradually increasing imperfect aëration of the blood, local pulmonary congestion, œdema, or emphysema; or 2d, By preventing the extension of the membranous or plastic exudation downwards. The former of these indications, I believe, would be met by early operation; the second and more formidable, I fear, would not; for the cases I have operated on show that in certain cases the tendency of tracheal and bronchial exudation to spread downwards continues after the operation has afforded a period of relief, if it be not even increased by the presence of the tube. The presence of the tube—it has been supposed by some—is a means of keeping up the irritation and inducing the false membrane to form; but this danger, I believe, is overrated.

We are not to perform tracheotomy on every child with a bad cough in croup, for many of them have this paroxysmal cough without being suffocated, and under ordinary treatment the child will get better; but in the second stage of the disease, when the false membrane is forming or has formed, we have a mechanical obstruction, and, besides this, the irritation and the small size of the air-passage justify us in operating. The late Mr. Liston used to object to tracheotomy in croup, on the ground that, if we operated early, there was no physical obstruction of the breathing to warrant it, and that if we delayed till the symptoms were urgent, the tracheal exudation rendered the operation useless. To neither of these propositions can I assent; but I think we are hardly warranted in operating till all remedies have been actively tried without effect; then there should be no delay. Here, as in many cases, the period of the disease, as regards time, is no criterion. If, in a case of croup, depletion, the warm bath, emetics, counter-irritation, calomel, and other remedies, have been actively used without

relief ; if the hard, ringing cough has become suppressed, and the respiration is evidently imperfect, as shown by the contracted and depressed appearance of the cartilages of the ribs and by occasional severe paroxysms of dyspnœa ;—I, for my own part, would say that the operation is fully warranted. When the paroxysms become more and more frequent, or when the dyspnœa is rather persistent than paroxysmal, with turgid or pale lividity, the operation is the little sufferer's only chance for life. Another reason for performing tracheotomy is that, even in the fatal cases, the relief afforded to the patient before death is very great. I consider that the mere temporary relief to the fearful death from suffocation is sufficient to warrant us in operating ; death is, at least, rendered more easy.

LECTURE CV.

Diphtheritic Croup : its nature as compared with Simple Croup—Duration of Disease and modes of Death, illustrated by Examples—Complications arising from previous Disease and present Contingencies—Indications for performing the Operation of Tracheotomy, and Cases best suited for it—Contra-indications—The stage of the Disease when it is most likely to be successful—Local and Constitutional After-treatment.

ANOTHER form of laryngeal disease which we must notice is DIPHTHERITIC CROUP.

Though experience has shown such an amount of success after the performance of tracheotomy in ordinary croup as to warrant the operation, it does not follow that in diphtheritic affections of the air-passages it would be equally warrantable. *A priori* reasoning, indeed, would almost lead to the conclusion that it is scarcely warrantable at all. All the circumstances seem unfavourable. Not only have we an equal, or even greater, tendency in the diphtheritic exudation to spread downwards, than we have in the case of the false membrane of croup, but the disease may even affect the wound caused by the operation. Moreover, it is a blood-disease of a very subtle nature, and of a most debilitating character, affecting the nervous system peculiarly, and destroying its victims by exhaustion, even when there is no laryngeal or tracheal obstruction. Yet, so far as my own experience goes, the actual results of tracheotomy in diphtheritic croup show such an amount of success, as in the otherwise desperate state of the patient fully warrants its performance. I have now performed tracheotomy about forty times in diphtheritic croup, and the results are rather more than one in three saved, which is slightly more favourable than in simple croup. Still I do not think that these are such favourable cases for the operation as those of simple croup.

As regards the causes and mode of death in diphtheritic, as contrasted with ordinary croup, I shall—to save repetition—divide the fatal cases into two groups, according to the mode of death. Under the first head I shall arrange those who died of asphyxia, from the exudation developing itself beyond the opening in the trachea, or into the minute bronchial tubes. Of these cases one was a child about two and a half years old, who had been under treatment for diphtheria, when urgent croupous symptoms supervened. The operation was resorted to, and was followed by great temporary relief. But next day dyspnœa returned, and the child died. In another case, that of a fine boy about eight years old, who had suffered, but was recovering, from slight sore throat, symptoms of croup supervened, and became so urgent that I was called to operate. This was attended with great relief, and all promised well, when diphtheritic exudation appeared, at first on one tonsil, and then gradually spread. The pulse rose, and the patient became more restless. Though the tube was kept clear, and changed several times, the breathing became embarrassed. Air passed easily out and in, and the walls of the chest seemed to expand; but it was clear, from the lividity, restlessness, and dyspnœa, that the exudation must have extended to the minute ramifications of the bronchi, thus preventing aëration of the blood. In the case of a little girl about five years of age, the symptoms appeared after the disease had lasted for eight or ten days, and were so urgent that I operated immediately. The relief was complete at the time, and for twenty-four hours all promised well; when suddenly difficult breathing recurred. This was relieved by changing and cleaning the tube; but that gradually failed to relieve, and she ultimately died in a suffocative paroxysm, apparently from the exudation having extended downwards. Now this form of death—the extension of the mechanical obstruction downwards below the opening in the trachea—is very like what takes place in ordinary croup.

The second and larger group of fatal cases is formed of those patients who died from the sixth to the twenty-first day after the operation, in consequence of asthenia, the effect of the

blood-poison. In some of these there was occasionally the complication of recurring dyspnœa ; though more in appearance than reality, the jactitation and restlessness being rather due to febrile excitement. Without detailing every case, I will select two or three typical of the conditions alluded to. The first example I select is that of a previously healthy girl of five years, a patient of Dr. Menzies. The history of the case at first was that of ordinary croup, progressing, in spite of active treatment, to threatened suffocation, for which tracheotomy was performed, with immediate relief ; and for the first four days everything seemed favourable. Then the pulse became quick, but weaker, accompanied with febrile excitement. The white diphtheritic pellicle was first noticed on the pharynx on the fifth day. In the course of that day it spread over the tonsils, uvula, palate, and mucous lining of the cheeks and lips. Next, she was noticed to swallow with difficulty, part of the fluids regurgitating by the nares, and part passing out through the tube. The tube was one with a small perforation on its convex side. The pulse became more rapid, and the patient sank exhausted on the eighth day after the operation. In another case of a girl, about three and a half years old, also a patient of Dr. Menzies, I was called to operate on the third day of the croupous attack ; but the child had been ailing for some days before Dr. Menzies had been called, and the diphtheritic exudation was seen over the tonsils, uvula, and palate. At the time tracheotomy at once relieved the intense suffocative symptoms. The tube was finally removed on the tenth day. There was no recurrence of difficult breathing, and I was only seeing the patient occasionally, as, judging from past experience in croup cases, I thought her quite safe, and trusted that the quick pulse and febrile state would gradually pass off. I happened to call on the eighteenth day after the operation, and found her sinking ; the eyes hollow and sunk, the wound showing total want of action, and looking larger than when the tube was removed. I was told that Dr. Menzies had ordered wine and suitable nourishment ; and, on asking if she had taken it, the mother said, Yes ; but a great part of it always

came out by the wound in the neck, and by the nostrils ; but she had never mentioned this to Dr. Menzies or myself. I hastened to have the child fed by the stomach-tube, but she was moribund, and died before wine or food could be administered.

As an instance of the deadly character of the blood-poison of diphtheria, independently of the mechanical obstruction to breathing, I may mention the following case :—I was sent for by Dr. Thin of Penicuik, to operate on a child residing near Eddleston. Dr. Thin told me that the symptoms preceding the laryngeal affection had been of a very low malignant character, but that the suffocative condition seemed now so bad as to demand tracheotomy to give a chance of relief. We found the child semi-comatose, with weak, intermitting pulse, clammy skin, and livid countenance. I operated as speedily as possible, and thought the child would have succumbed. At first, no great relief seemed to be given to the breathing, but after waiting a little, and stimulating the trachea by passing a probe through the tube, coughing was induced, and some blood, mucus, and a shred of membrane, were ejected. The breathing then became easier. After having replaced the child in bed, applied warmth, and given necessary directions, we were about to leave, when we were startled by hearing the little patient, hitherto apparently unconscious, say, with wonderful distinctness, “ Gude mornin’ !” I now recollected that the tube I had used was one with an opening on the convex side, so that air would pass through the larynx. I thought the strength of voice a good omen of returning power, and that possibly the former almost moribund condition of the child had depended on non-aëration of the blood ; but on laying my finger on the pulse it was scarcely to be felt, the skin was as cold and clammy as before, and although the breathing had been relieved, the child died in about three hours after the operation.

These may suffice as examples of the modes of death in diphtheria after tracheotomy. As a general rule, death in cases of simple croup occurs early in the second or third day after the operation. In diphtheria life may be prolonged for two or three

weeks, and death may occur by gradual exhaustion from the disease—a result either of the blood-poisoning alone, or of that combined with paralysis of the pharynx, preventing deglutition, and so interfering with nutrition ; by a similar affection of the glottis—allowing fluids to enter the trachea or wound ; or lastly, by the diseased action attacking the wound, and leading to phagedæna. I have also known death occur, in the case of an adult, on the second day after the operation, from paralysis of the heart, though the dyspnœa had been completely relieved.

The most formidable complications are those dependent upon the peculiar affection of the nervous system, causing paralysis of the pharynx, giving rise to the inability to swallow, or of the palate, leading to regurgitation of food through the nostrils. These two conditions have long attracted attention ; but I am not aware that the similar affection of the glottis has been adverted to, though I have repeatedly noticed and remarked it to my medical friends. In the first case in which I saw the fluid food come through the tube, I was afraid that ulceration had occurred between the pharynx and larynx. When satisfied that such a state did not exist, I thought the phenomenon might be due to the kind of tube used, with an aperture on its convex side ; but I have found it occur equally in cases in which the ordinary tube was used. The fluid must then have passed the glottis without causing any cough, and only have been ejected when it stimulated the bronchi, or trachea below the tube. In other words, the fine sensitive nerves, which act as sentinels at the outwork of the air-passages, become paralysed, and no effort to close the glottis is made during the attempt at deglutition ; and so part of the fluid passes down the larynx and trachea, till, by stimulating the bronchial membrane, it gives rise to its own ejection through the tube or wound. This condition seems peculiar to diphtheria, for although I have now had a very large experience of tracheotomy, performed for different kinds of disease or accident, I have never seen the fluid food ejected by the tube except in that disease. I think it more important on this account, that, whilst our attention is attracted

to it after tracheotomy when we see the fluid ejected, the question comes,—Is it not probable that the same paralysed state of the glottis may allow portions of fluid nutriment to pass into the air-passages in other cases of diphtheria in which tracheotomy has not been performed?

I would now, in conclusion, state my impressions as to the propriety of performing tracheotomy in certain cases of diphtheria, or of refraining from its performance in others, derived from what I have observed in cases in my own practice.

First, then, the great and positive indication for operation is the immediate urgency of the suffocative laryngeal symptoms. When these are intense, and the contracted state of the thoracic parietes shows that little air is entering the chest, the operation is warranted, as affording the only chance of obviating impending death from asphyxia; and this, the only chance, may be given, however unfavourable the prognosis as to ultimate success. The results of the successful cases point to the fact that the more favourable cases for operation are those in which the laryngeal symptoms have commenced early and progressed rapidly, with, perhaps, decided local diphtheritic symptoms, but the febrile or constitutional symptoms less prominent;—where, in fact, there is least intensity of the constitutional poison, and where the very acuteness of the local symptoms indicates a certain amount of power.

The cases less suited for operation are those in which the constitutional morbid conditions have existed in a marked form, together with fever, quick and weak pulse, for some time before the exudation affected the air-passages, and in which the croupous dyspnœa is not very intense. Occasional paroxysms of convulsive cough occurring in such cases, and relieved by the ejection of mucus and false membrane, unless increasing in frequency, do not warrant the operation. Nor is it warranted in cases where, to speak generally, the colour of the face and lips, and the state of the chest, show no continued obstacle to respiration. Cases in which the diphtheritic affection has supervened on scarlatina, measles, or gastric fever, or in which there is marked

submaxillary swelling, are very unfavourable. I have, however, seen cases recover, where tracheotomy was performed in diphtheritic croup supervening on these circumstances; so that I think we may perform the operation, though we should not urge it too much. I would not like to exclude even such cases from the benefit of the temporary relief and the chance of life which tracheotomy affords; still it is evident that the chance is very much less than in cases of uncomplicated croup, and that the results must tend unduly to reduce the average success of the operation.

In cases in which the disease has crept slowly on before the croupous symptoms began, and in which difficulty of swallowing exists, that complication seems to me a contra-indication of operation, as we can then scarcely hope to keep up the nutrition of the patient. But we must look to the exact significance of this symptom in diphtheria. In cases of acute and chronic laryngitis, as well as in croup, difficult deglutition is often a very marked symptom; but, so far from being a contra-indication to tracheotomy, it is an indication for its performance, because in such cases the difficulty arises from the action of the parts in swallowing, exciting the laryngeal spasm. In these cases it excites cough and other symptoms of laryngeal irritation; but the dysphagia of diphtheria results from paralysis of the palate, pharynx, and neighbouring parts. There are no convulsive efforts excited to expel the food—it simply runs back, partly from the mouth, partly by regurgitation through the posterior nares; and, as we see in cases in which it comes on subsequently to the operation, part of it may pass through the larynx into the trachea. Hence I consider the presence of this condition in diphtheria most unfavourable, both as an indication of the intensity of the poison, and also and specially as presenting a difficulty to our afterwards nourishing the patient. When it comes on after the operation, we must do our best to meet it by the use of the stomach-tube; but I can only say that such treatment has rarely proved successful in my own cases.

Lastly, in regard to early operation as promising greater

chance of success.—Whatever the greater chances may be in ordinary croup, I can see no grounds on which we can hope for its being useful in diphtheria. Indeed, I do not think the operation warrantable until the laryngeal obstruction or spasm is well marked ; because it superadds new sources of irritation and risks of its own, such as that of the disease attacking the wound ; and thus the operation might deprive the patients of chances of recovery which they would otherwise have.

I trust, however, I need hardly say that I do not mean to advocate delay when the laryngeal symptoms are marked and progressing ; for then unnecessary delay entails the risk of the supervention of congestion or œdema of the lungs, and so diminishes the chances of success of the operation.

In the *After-treatment* of Simple or Diphtheritic Croup, where tracheotomy has been performed, one thing ought to be attended to—namely, the form of tube—as this is important. It ought to be of such a size as will admit air freely, without over-distending the trachea, and should always be double, the inner tube fitting pretty closely, but *not* secured to the outer, either by spring or other fastening, so that it may be easily removed for cleaning, or expelled by the efforts of coughing, if obstructed by mucus. The inner tube should also be long enough to pass beyond the outer one, so that we may be sure that there is no obstruction to the passage of air through it ; for if the inner tube be clear, and longer than the outer one, all is right. The tube should not be tied in too tightly, for fear of interfering with the venous circulation, and there should be no knot near it. We must of course see that the tube is introduced fairly into the trachea, though it must not be inserted too deeply.

When there is much bronchial effusion, the use of emetics in the after-treatment is very beneficial ; but under no circumstances would I now resort to antimony, for its effects are most dangerous in diminishing the expulsive power, depressing the patient, and inducing sinking. I am glad that my opinion on this head is strengthened by the high authority and great experience of M. Trousseau. In all respects I find ipecacuan answer better, either

as an emetic or expectorant, without depressing or leading to dysenteric purging, whilst it induces moderate diaphoresis and allays the febrile condition. The rest of the after-treatment consists in keeping the air of the room moist by letting steam pass into it near the bed : this so far moistens the mucus in the throat, and it is therefore more easily ejected through the tube. The bronchitic affections are also relieved, and simple poultices on the chest, and sinapisms on the back, are useful to allay irritation and congestion. In regard to diet, it is in many cases necessary to give beef-tea and wine from the first ; but in general I prefer for the first day or two a nutrient, non-stimulating diet, such as milk and farinaceous food, and afterwards gradually give animal food ; but in respect to this we must be guided by the condition of each individual patient.

LECTURE CVI.

Chronic Laryngitis : Causes ; Symptoms ; Diagnosis ; Treatment—Warty Disease of the Larynx—Secondary and Anomalous Affections causing Laryngeal Symptoms, as Tumours of the Thyroid, and Thoracic Aneurism—Symptoms common to both conditions—Value of the Laryngoscope as an aid to Diagnosis : Directions for using it—Operations of Laryngotomy and Tracheotomy in the Child and Adult : After-treatment.

THE CHRONIC DISEASES OF THE LARYNX include chronic thickening of its mucous lining arising from repeated attacks of acute or sub-acute laryngitis ; ulceration from the effects of tertiary syphilis ; necrosis of the cartilages, from syphilis or other causes ; also swelling of, and sometimes a tubercular deposit in, the mucous membrane, in scrofulous patients, leading to irritation and spasm, and not unfrequently to œdema glottidis.

The patient, when suffering from chronic laryngitis, may get a little fresh cold ; a sort of subacute attack supervenes—effusion from the vessels occurs into the loose cellular tissue, which, superadded to the previously existing swelling, nearly blocks up the larynx, and if irritation and spasm come on, death may result. Whilst these chronic conditions vary to a certain extent, the immediate cause of death is generally a sudden attack of œdema glottidis. A patient so afflicted has generally, in addition to a troublesome and harassing cough, very marked symptoms of general debility. He presents a pale and sickly aspect. His lips are blanched or livid. There is often venous engorgement of the neck and arms, owing to imperfect aëration of the blood. He has a feeble and irregular pulse, often suffers from distressing breathlessness, and is frequently found to be much emaciated, especially when there is the co-existence of any tubercular disease. He complains that the paroxysms of coughing become worse at night, and that they sometimes bring

on suffocating attacks of dyspnœa. In such a case we may employ the ordinary treatment—such as the application of sulphate of copper or nitrate of silver to the throat, blisters on the neck, and cod-liver oil and iodide of potassium internally; but we cannot trust to these entirely. There is the danger that the patient may die during one of the attacks; and if their recurrence be frequent, I would strongly urge the operation of tracheotomy. In these cases we sometimes require to keep in the tube permanently. In one hospital case I have performed tracheotomy three times successively. The tube had been taken out when it should not, and the opening in the trachea gradually closed up, requiring the operation to be again performed. The boy's health, each time, improved very much after the operation.

The improvement of the general health is often very marked. I recollect a case which occurred in Professor Gairdner's practice. I was called to see in his ward a girl who was suffering from phthisis. She was in the very last stage of exhaustion, and very much emaciated. Owing to the condition of her larynx, the suffocative paroxysms had increased in frequency and severity, and hence the demand for surgical aid. I saw her during one of these paroxysms, and at once performed tracheotomy. The girl was so weak that she fainted during the operation, but from that day she began to regain strength; and within two or three months was perfectly well, and lived for several years afterwards. The marked improvement in the general health, after the operation, is itself a warrant for performing tracheotomy in these chronic affections of the larynx, to say nothing of the danger that, if it be not performed, the patient may at any moment be seized suddenly with œdema glottidis, or with suffocative spasm during a paroxysm of coughing, and die before assistance can be obtained. Hence we should perform tracheotomy in these cases, as it is the only means of completely averting the danger. We can afterwards apply our local treatment to the larynx through the wound, just as we can to any other ulcer in the body. I have had a very large experience in operating in such cases, and

the results have been almost uniformly successful. I therefore strongly advise that the operation be performed when the condition is going on from bad to worse, and when the paroxysms are becoming frequent, even though they be not present when we see the patient ; for when spasm is absent, we can give the patient chloroform, and perform the operation easily. We may remove the tube after a little, and if necessary insert it again. The tube, when retained permanently, should have a hole on its convex side, so as to allow the patient to speak.

There are some cases of chronic disease of the larynx which are comparatively rare. For example, the *Warty Disease*, in which the diagnosis is rather difficult. The patient suspects the diseased condition sooner than the surgeon. He feels something like a small pea or seed hanging in his larynx, and there is irritation and cough. Formerly, when the diseased condition was made out, we performed tracheotomy without hesitation, and removed the excrescence ; but now there may not be any necessity for the operation, as a skilful operator with the laryngoscope may sometimes succeed in removing them by the mouth with a pair of forceps made for the purpose.

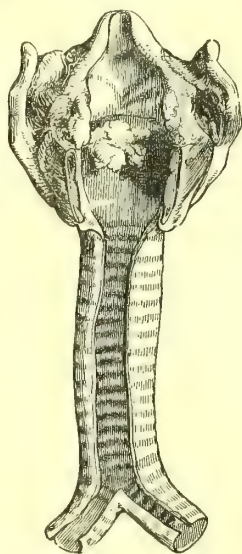


Fig. 31.*

There are other conditions of an anomalous nature requiring tracheotomy. A large tumour of the thyroid body, for instance, may produce spasm of the glottis by irritating the recurrent laryngeal nerve. In one case of this kind the disease disappeared under treatment by blisters locally and iodide of potassium internally ; but after two years the patient returned with the tumour as prominent as ever. I then proposed to tap the cyst of the tumour, but before I could do this my house-surgeon was obliged to perform laryngotomy.

* Warty disease of the Larynx.

Another and much more frequent class of cases are those of laryngeal spasm, produced by the presence of THORACIC ANEURISM. This is an important subject, for surgeons are constantly being called upon to perform tracheotomy for aneurism of the aorta or of the innominate artery. There are two classes of cases of aneurism in which we may interfere, but only in one of them with advantage.

The first and favourable class of cases are those where we have an aneurism pressing upon and irritating the recurrent laryngeal nerve, causing frequent spasm of the muscles supplied by this nerve, and therefore leading to threatened dyspnœa and asphyxia. Here there is no direct pressure by the aneurism on the trachea ; it is a reflex action, and in such cases the performance of tracheotomy will relieve the breathing and prolong the patient's life, and it may subsequently improve the condition of the aneurism itself. But if we have an aneurism situated on the arch of the aorta, or on the innominate artery, pressing on the lower part of the trachea, just at its bifurcation, the case is different. There we have difficulty of breathing, and we may also have laryngeal spasm, but the aneurism presses directly on the trachea below the point at which we could perform tracheotomy. We cannot safely pass down a tube to relieve the breathing, so that we cannot afford even temporary relief by the operation, therefore we are not warranted in its performance. We must keep in mind that there is a very great risk of opening the sac either with the knife or the extremity of the tube.

I was asked one morning to go and see a case of aneurism, in which the patient had been suffering from double bronchitis for some time. From the stridulous laryngeal character of the breathing, her medical attendant thought that tracheotomy might be required. I was very tired at the time, and asked him to consult a physician, and stated that if the operation was necessary I would perform it. I was not sent for, and on asking for the patient I heard that she was dead. The physician was depressing the tongue with the handle of a spoon, to examine the throat, when a sudden gush of florid blood destroyed the

patient. This was a case in which an aneurism had pressed on the trachea, and had tracheotomy been performed, the patient would almost certainly have died under the operation from loss of blood, owing to the part of the sac projecting into the trachea being injured with the knife or tube. In these cases there is also great venous congestion in the neck, which makes the operation much more difficult.

Huskinness of voice and a stridulous laryngeal cough are symptoms common both to such cases of aneurism and to chronic laryngitis. When there is difficulty in distinguishing between the two affections, the laryngoscope again proves most valuable, as with its aid there is observed in the one case swelling or ulceration in the interior of the larynx, and in the other nothing but paralysis or spasm of one of the vocal cords.

A few observations regarding the use of the laryngoscope may not be out of place in concluding this account of the injuries and diseases of the larynx.

In principle the instrument is very simple. It consists essentially of a small mirror fixed upon a stalk, so as to be capable of introduction into the back of the throat. Holding it there in such a manner as to deflect the light at the proper angle, the surgeon is enabled to obtain a good image of all the parts within the larynx. The mirrors now employed are flat, and usually circular, varying from the size of a sixpence to that of a florin, and they have the ordinary glass and quicksilver face with a metallic back. Each is fixed by its edge, at an angle of about forty-five degrees, to a stalk of soft metal, which is furnished at the other end with a wooden handle. When the operator can employ the direct rays of the sun, nothing more than this single mirror is necessary to obtain a good image of the larynx. But as we cannot always have the sun's direct rays at our disposal, it is necessary that we should possess some additional means by which we may concentrate the light of a lamp or of a window, so as always to have a powerful illumination at our command.

The instrument, as practically used, therefore, now consists of two parts : first, of a series of the small throat mirrors, varying

in size as just described ; and, secondly, of a circular reflector, slightly concave, and perforated in the centre like that of the ophthalmoscope. The latter is the concentrator of the light. It is adjusted in front of the operator's right eye, being fixed in position by its attachment to a pair of spectacles made for the purpose, or better, perhaps, by a belt which encircles his head. The joint by which it is thus attached ought to allow considerable latitude of movement in every direction, and at the same time be stiff enough to retain the mirror in position at any angle. It is now usually made upon the ball-and-socket principle, as this is the most simple and most easily tightened when it becomes loose.

In using the instrument, the operator places his lamp, which may be a good oil one or a strong gas jet, above and slightly behind the patient's right shoulder, so that his face will be in the shade. He is then requested to put out his tongue, and to retain it so by holding the point with a handkerchief between the right forefinger and thumb. The chin, at the same time, is slightly raised, the neck stretched forwards, and the mouth well opened. In this position the operator, throwing a strong light into the throat from the large reflector, may first, at a glance, examine into the state of the mouth and fauces. He then, to prevent tarnishing with the breath, gently heats the small throat-mirror, either by placing it for an instant over the lamp, with its glass face downwards, or by dipping it in hot water. Holding it now by the stalk, like a pen, he carefully but promptly introduces it into the throat, avoiding contact with all the parts except the soft palate and uvula, against which he applies the metallic back of the mirror, pushing it gently backwards and upwards. The handle, which is held at the angle of the mouth, is at the same time slightly depressed, until the proper angle of reflection is obtained. It is well for the operator to ensure the steadiness of his hand by resting the tips of the ring and little fingers against the cheek of the patient.

The extent of the parts thus displayed varies greatly in different individuals. The epiglottis can almost always be dis-

played ; but in the majority of instances this valve overlaps the vocal cords so much as at first to hide all but their posterior extremities from view. If, however, the patient be desired to sing a prolonged note, rather high in the scale, it will be drawn upwards so as to expose them posteriorly to a considerable extent. The anterior extremities are rarely or never brought into view. If the patient be now desired to take a long breath, the glottis will at once be thrown open to its widest extent, and in many cases a good view may be obtained of the upper, and sometimes even of the lower rings of the trachea.

The beginner will find the use of the instrument by no means easy, on account of the delicacy required in its manipulation ; but with patience he will easily overcome most of his difficulties. It is of great importance to make the examination deliberately, and in such a manner as not to alarm the patient. The most common difficulty arises from excessive irritability of the fauces ; and this is greatly increased if the patient be excited or alarmed. It is well in all cases to pass some little time in conversation after arranging the light, so as to allow all nervousness of your patient to subside, especially as the first trial at a sitting is usually the most successful, the majority of throats becoming irritable when repeatedly touched by the mirror. There are some patients whom, owing to exceptional formation of the parts, it is impossible to examine successfully with the laryngoscope ; but these are very few in number. Where irritability is so excessive as to render your first attempts futile, it is well to repeat the trial from day to day, until the throat becomes accustomed to the touch of the mirror ; and in such cases it is recommended that the bromide of potassium be administered internally, in full doses, so as to allay any existing hyperæsthesia ; but of course this plan of treatment can only be adopted when the circumstances of the case will admit of delay.

In the case of foreign bodies in the air-passages, the laryngoscope is likely to prove exceedingly valuable. With its aid the surgeon is enabled to make out the exact nature and situation of

the body, if it be within the larynx ; and, if he be skilful in the use of the instrument, he may even succeed in extracting it with the laryngeal forceps now employed in removing polypi and other growths from the glottis. Should any circumstance in the case, however, render the trial of this method of extraction inexpedient—as, for example, great irritability of the fauces, or firm impaction of the foreign body below the level of the vocal cords—the surgeon will at least proceed with the greater confidence to operative interference when he has ascertained the exact situation in which he may expect to find it. In these circumstances, when the body is evidently in the larynx, the best treatment would be to perform the operation of laryngotomy, as by this means the surgeon cuts directly down upon the offending substance, making it visible through the incision, and, of course, rendering its removal extremely easy.

The operation of LARYNGOTOMY, except in its situation, is very much the same as that of tracheotomy. The superficial incision should be commenced about the middle of the thyroid cartilage, and prolonged downwards in the mesial line to the lower border of the cricoid, and the deep incision is made in the same direction through the crico-thyroid membrane into the larynx ; but in order to get sufficient room, it is frequently prolonged downwards through the body of the cricoid cartilage, or the crico-thyroid membrane may be divided transversely. In the course of the operation the edges of the two sterno-hyoid muscles are separated from each other, and a few veins which lie over the larynx are to be avoided, as they may be sources of bleeding. Some little hæmorrhage may also take place from the small crico-thyroid arteries, which cross the crico-thyroid membrane in a horizontal direction, but these seldom give any trouble.

I would now, in conclusion, offer a few remarks upon the more important operation of TRACHEOTOMY.

The operation of tracheotomy is one often spoken of as perfectly simple and easy, and so it is in many cases ; but even in

the adult, the state of a patient struggling in the agonies of suffocation, often renders its performance by no means so simple as generally described ; and in children from three to five years of age, in whom croup is most common, it is attended with much greater difficulty, or at least requires greater caution, than in the adult. I believe success depends a good deal on the manner in which it is performed, and attention to some minutiae in its performance.

There ought to be no attempt at rapidity or brilliancy in this operation ; every step should be methodically gone about. First, as regards the position of the infant, the shoulders should be well raised, the head bent moderately backwards and supported by an assistant, who should pass one arm under the pillow behind the neck, so as to project or support it forwards, whilst with the other hand he keeps the head fixed with the chin in the middle line as a guide to the surgeon. The arms and legs may be controlled by a small sheet or large towel pinned round the body, the arms placed by the side ; and when thus secured, one person can control the movements. Care should be taken to see that the teeth be not firmly closed, but that the mouth be partially open and the nostrils free.

The external incision should begin over the cricoid cartilage, and extend downwards exactly in the middle line for about two inches. If the incision be not exactly in the middle line, the trachea may be cut into laterally, and in that case it would be difficult to retain the tube afterwards, or the carotid arteries might be wounded. In general, two large veins, one on either side of the mesial line and close to it, are seen when the skin is divided ; the fascial texture between these, corresponding to the intermuscular line, is readily divided by the point of the knife, and then these veins can be easily drawn aside.* Sometimes one vein crosses the line to join the other, and may even require to be divided after being secured by ligatures : this is embarrassing ; but the point most to be attended to is caution after separating the tracheal muscles. These muscles are sepa-

* See Plate xlix.

rated by dividing the fibro-cellular tissue connecting the margins of the sterno-hyoid muscles, in the line and to the extent of cutaneous incision. If the finger be placed deeply in the wound at this stage, the trachea is felt pretty distinctly, and may seem so distinct as to warrant the surgeon in inserting his bistoury to divide the rings ; but I hold that this ought not to be done, because not only may there be the substance of the thymus gland flattened under the finger, but deeper, and passing from that gland to the thyroid, there exist numerous vessels which would bleed profusely. I have more than once pointed out this to the gentlemen assisting me at my operations. After separating the lobes of the thymus gland, even after these vessels and the thymus are pushed aside, I clear the rings of the trachea with the knife from loose cellular tissue, so that there may be no obstruction to the entrance of the silver tube when the opening is made in the trachea. In cases of croup the tube should not be introduced too quickly, as in that case it might prove an obstruction to the ejection of the false membrane. I generally keep the opening in the trachea patent by means of a double blunt hook, which I have devised for the purpose, until such time as the detached shreds are coughed up. Should there be venous bleeding, however, the tube must be inserted at once. On the tube being introduced, the head should be bent slightly forwards.

The description just given of the steps of the operation in children, is that which I gave in a paper read before the Medico-Chirurgical Society of Edinburgh, ten years ago, after a very considerable experience in performing tracheotomy on children ; and after a still larger experience (now, I believe, the largest of any surgeon in this country, having performed it ninety-seven times on children), I have nothing to alter in or add to my directions. By attending to the rules laid down, whilst all hurry should be avoided, the operation will be executed at once safely and expeditiously.

In some very extreme cases I have found it necessary to proceed very rapidly, as the infants were apparently asphyxiated,

Fig. 1

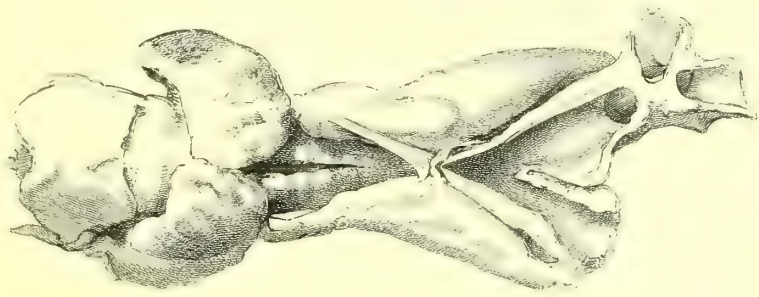


Fig. 5

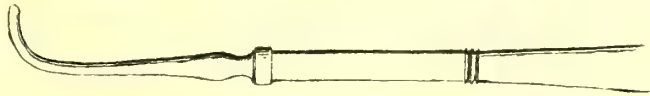


Fig. 3

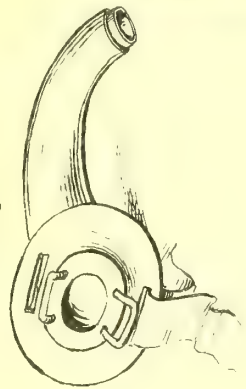


Fig. 4

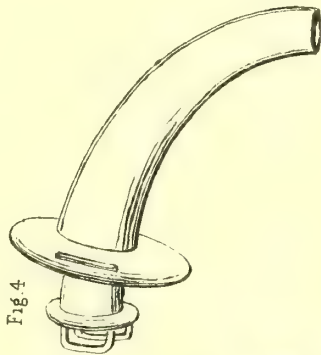


Fig. 2

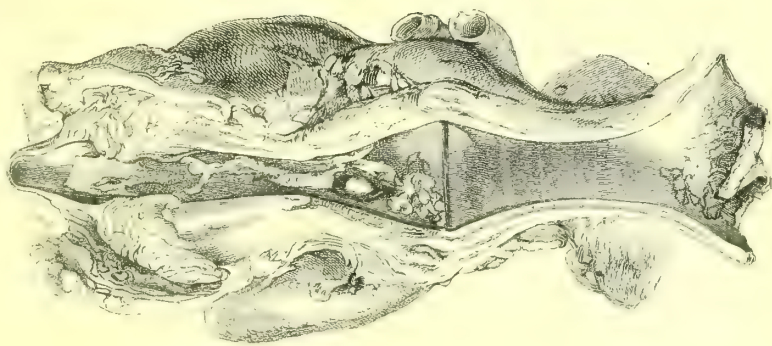
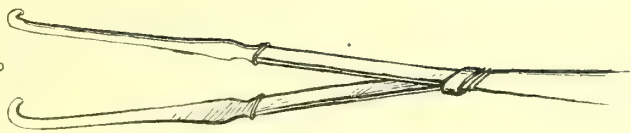


Fig. 6



and by passing a feather down the trachea, sprinkling cold water on the face, and performing artificial respiration, I have succeeded in restoring animation ; but, except in such cases, there should be no great haste.

In performing tracheotomy in the adult, whilst the general steps of the operation are the same, and whilst it is easier of execution in most cases, yet in some respects it presents difficulties peculiar to adult life. In children, the space in which we have to make our incisions is absolutely smaller than in the adult, but, relatively, the space is greater between the isthmus of the thyroid gland and the top of the sternum. The space occupied by the larynx and hyoid bone is small, and the cervical portion of the trachea is longer than in the adult. The development of the larynx in the adult alters the relation of parts ;—the space between the chin and the lower margin of the cricoid cartilage is increased, whilst the space between the cricoid cartilage and sternum has diminished. The trachea is thus shorter, and not only so, but in proportion to the projection of the larynx and development of the thyroid gland, the trachea descends obliquely backwards from the surface, and its depth a little above the sternum is very considerably increased.

In the male, when the neck is short and muscular, the muscles tense, and the trachea working violently up and down as in threatened asphyxia, the difficulties of the operation are very great.

In some cases on which I have operated, I have found the trachea situated at a great depth from the surface, and so short a space between the thyroid isthmus and sternum, as not only rendered the operation difficult, but when completed, the orifice of the tracheotomy tube was almost drawn under the sternum, and I have occasionally been obliged to fix and draw the trachea upwards by means of a sharp hook, till the convulsive movements diminished.

As the diseases which require the operation in adults, have little or no tendency to spread downwards, I think that in them the opening in the trachea may often be made with advantage

above the isthmus of the thyroid, by pushing that structure down, so as to expose the upper rings of the trachea. Hitherto I have not done so; but from what I have seen of the difficulties in short muscular necks, I would especially advise that to be done when operating for laryngeal spasm depending on aneurism, particularly if there be any reason to suspect that dyspnœa depends on direct pressure, as by doing so we will diminish the risk of injuring the aneurismal sac on introducing the tube. Both in the adult and child it is sometimes advisable to fix the trachea with a sharp hook before opening it.

The position of the patient, and general steps of the operation, are the same as in tracheotomy in the child. The incision through the skin should be commenced a little above the cricoid cartilage, and continued downwards in the mesial line, for two or two and a half inches, through the skin, fat, and fascia, so as to expose the intermuscular texture connecting the sterno-hyoid muscles. The superficial veins are seen and guarded. Next the intermuscular texture is freely divided, and the sterno-hyoid and thyroid muscles separated with the handle of the scalpel. Then the large inferior thyroid veins and the isthmus of the thyroid body are pushed out of the way with the point of the finger, and the trachea opened, above or below the isthmus, as the nature of the case may determine. In operating on persons in whom the rings of the trachea are ossified, the surgeon should provide himself with a pair of very strong scissors or small bone-pliers, to divide the ossified rings. The trachea-tube should always have a broad shield or metal band to maintain it in position.

The after-treatment is somewhat similar to that for the operation for croup. Any venous hæmorrhage generally ceases when the difficult breathing is relieved. If, however, it should continue, a little bit of lint pressed under the shield of the tube will suffice to arrest it.

LECTURE CVII.

Injuries of the Pharynx arising from the Lodgment and Impaction of Foreign Bodies: Modes of detecting and extracting them by Manual and Instrumental means—After-treatment when they have entered the Stomach—Diseases of the Pharynx—Lateral and Posterior Pharyngeal Abscess—Stricture of the Oesophagus: Spasmodic and Organic; Simple and Malignant.

THE INJURIES AND DISEASES OF THE PHARYNX form a department of practical surgery which is well worthy of your earnest attention. I will therefore treat the subject in the manner which I think most likely to commend it to your understandings, and impress it on your memories—namely, by drawing largely from my personal experience for the illustration of the principles of treatment I advise.

INJURIES OF THE PHARYNX are generally caused by the entrance and impaction of foreign bodies which have been arrested in the act of being swallowed. These consist of pieces of food, fish-bones, pins, coins, false teeth, and like substances. Such accidents necessarily require immediate attention and great care, both in immediate treatment and after-treatment.

When small bodies, such as pins or fish-bones, get entangled in the pharynx, they generally lodge behind the tonsil or beside the hyoid bone, where they are, as a rule, within reach of the finger. In searching for them, we should pass our finger backwards along one side of the mouth, upwards and downwards between the pillars of the fauces, around the region of the hyoid bone, in front of the epiglottis and base of the tongue; then withdraw the finger, and, in doing so, make a similar search on the opposite side. A sharp body is most frequently impacted between the pillars of the fauces, where it can be easily recognised and dislodged by the point or nail of the finger; but it may be in a position lower down, and still within reach of the finger, although it cannot be extracted by it. In such cases the

finger can be used for detecting the position of the foreign body, and afterwards for guiding the point of the forceps to its site. These forceps must be used in this situation with very great caution and gentleness, for there is much danger in searching for foreign bodies with anything like carelessness ; and even with the utmost care there is considerable risk in fishing for such bodies with any instrument yet invented, for the condition of things may be aggravated instead of improved by their use. Thus, a sharp point may be driven further home, and a slight abrasion of the mucous membrane increased to a laceration. If the impacted substance be tolerably blunt, and beyond the reach of recognition by the finger, or removal by the forceps, the ordinary whalebone and sponge probang may be used with safety, to help it onwards towards its destination in the stomach or ejection through the mouth.

In some cases, where small sharp-pointed bodies are lodged far down, we may succeed in extracting them with the tubular expanding probang. This instrument consists of a fine whalebone probang, tipped with sponge, ensheathed in a gum elastic tube, except for about two inches above the sponge. From the point where the sheath terminates, a series of strong bristles are arranged longitudinally around the whalebone, and attached above to the gum elastic sheath and below to the sponge. The instrument, when closed, presents much the appearance of the common sponge probang ; but when the whalebone stalk is pushed, and then drawn a little back, the bristles are projected, and expand like a parasol, so that, on withdrawing the instrument thus opened, it sweeps the circumference of the œsophagus, and may catch and extract small foreign bodies sticking in the wall of the passage ; but it is more ingenious than practically useful, and in most cases the common sponge probang answers best.

It is often very difficult to detect the presence of a small body in the pharynx, and still more difficult to remove it. The difficulty and danger are increased if the impacted substance be sharp in its outlines, or have pointed or hooked extremities. Both these conditions are sometimes met with when a false

tooth is swallowed. I had to deal with a case of this kind some years ago, in the case of a lady who was subject to epileptic fits, and in one of these she swallowed a false tooth, the gold setting of which was much worn. Her ordinary medical attendant was sent for, but the tooth had passed beyond his reach. Later in the day he sent for me ; and, after a patient search, I discovered the presence of the foreign body by means of an ivory-headed probang. It was situated much beyond reach of the extracting forceps ; but, by means of the tubular probang, I succeeded in snaring it. The hook of the gold plate, however, had become fastened in the tissues, and for some time I could neither pull it upwards nor push it downwards. At length, however, I succeeded in unfastening it and in pushing it down.

Several years ago a young man, a dentist's assistant, presented himself at the Royal Infirmary here, and stated that he had swallowed a false tooth. He was seen and examined by the late Mr. Syme, who passed a probang, but could detect nothing by it. He therefore concluded that the tooth had passed down to the stomach, and he dismissed the patient. Some days afterwards the young man returned, and complained of pain somewhat keener than before. Again he was carefully examined, and nothing being detected, he was again dismissed. About six weeks after this the late Dr. James Duncan was sent for hurriedly to see the patient in his lodgings ; and, just as he entered the room, the young man vomited a large quantity of blood and died. On a post-mortem examination it was found that the small hook of the tooth had become inserted into the front of the œsophagus, through which it had ulcerated its way into the aorta : hence the fatal hæmorrhage.

In the case of a child who swallowed a button, I found it imbedded very low down in the œsophagus, and, as I could not extract it, I pushed it downwards into the stomach. It was afterwards passed by the bowel along with the fæces.

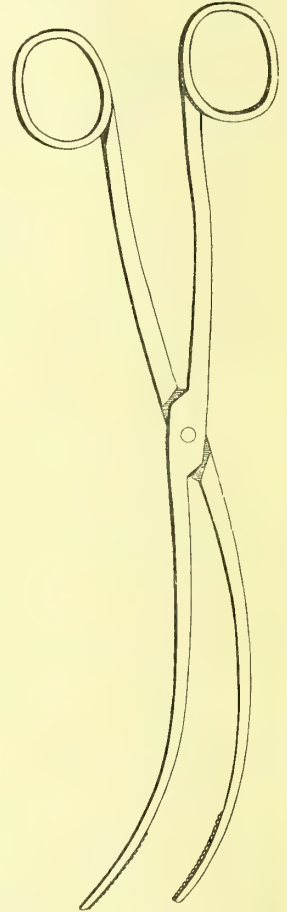
In another case I felt a coin : the small œsophagus tube with which I was examining the passage luckily twisted when I drew it up, and brought up the coin along with it.

In many cases foreign bodies, such as coins, lodge at the top of the œsophagus, and are readily extracted by the pharyngeal forceps. Of these, two pairs, the blades of which open in dif-



Fig. 32.

ferent directions, are generally required, so as to adapt them to seize the foreign body according to the position in which it may be. These forceps should always be used with great care, so that the foreign body may not be pushed downwards, if its extraction be at all possible. When a smooth rounded body, such as a coin, has entered into the stomach, we, of course, desire to get it evacuated by the bowels as speedily as possible. Our object is to accelerate as much as possible the passage of the foreign body through the intestine, so as not to



afford time for permanent lodgment. This can be best accomplished by giving, in addition to bulky farinaceous food, gentle laxatives, such as small doses of castor-oil ; after two or three of which the foreign body is generally passed along the small intestine very readily. There is a risk that it may lodge in the large intestine about the cæcum or sigmoid flexure, and therefore large distending enemata are very useful. The stools should

be carefully examined, so as to make sure of the foreign body passing away.

When sharp-edged or pointed bodies, as false teeth, with sharp or hooked metallic fixings, enter into the stomach, the treatment requires to be somewhat different. Purgatives would be dangerous. It is necessary to blunt or cover over the sharp edges, so that they may pass through the bowels safely. For that purpose I generally order the patient to eat freely of raw prunes or figs, without chewing them much, that a coating may envelop the sharp points or edges of the foreign body, so as to enable it to pass safely through the intestine.

Bones, or portions of bone, often require to be forcibly pushed into the stomach, where, from their digestibility, they are not dangerous. Even the horn handle of a penknife has been found in the stomach nearly dissolved.

Should portions of soft food stick in the gullet, they ought at once to be pushed into the stomach. In using the probang, or stomach tube, the finger should be passed down on the left side of the mouth, the tongue being neither pulled forwards nor pushed backwards, so that the parts be left as nearly as possible in their natural position. The head should then be thrown back, and the probang or tube passed almost vertically downwards over the finger. When the foreign body is touched, it may be fairly pushed into the stomach.

Poisonous substances which may have entered into the stomach, if soluble and non-corrosive, should immediately be withdrawn by the stomach-pump. The use of the instrument should, however, be always avoided in cases of corrosive poisoning, because, while there is little or no chance of doing good, the tube may pass through the softened gastric walls into the abdominal cavity. In some cases of poisoning by acid, we ought to pass the tube into the œsophagus, and thereby inject alkalies into the stomach. Earthy or alkaline carbonates are generally objectionable, from the effervescence and distension produced by the liberation of carbonic acid gas.

The stomach-tube sometimes terminates in an open mouth,

with the view that the grosser portions of the contents of the stomach may pass into it easily. This, however, is an objectionable form of the instrument, for the mucous membrane of the stomach is liable to be sucked in, and often seriously injured, while the tube is closed against the ingesta. The extremity of the tube should be closed, and the eye of the instrument ought in all cases to be very large, and beyond and above the point of the tube. To save time and trouble in emergencies, the instrument should never be fitted with screws, but with slip-joints. When poisoning is suspected, tepid water should be pumped into the stomach to hold the poison in solution. The fluid should then be pumped out, and the process repeated until the water is quite clear when withdrawn, and there is good reason to believe that the poison has been wholly, or as far as possible, removed.

The surgeon may require to perform ŒSOPHAGOTOMY, when a foreign body is so fixed in the œsophagus that it can neither be drawn up nor pushed downwards. The obstruction is generally in the upper part of the œsophagus. The incision for œsophagotomy should be made a little nearer the middle line, but very much in the direction of that for ligature of the left common carotid artery. The skin and fascia being divided, the sterno-mastoid is drawn aside, and any vessels which may bleed are tied. The finger, or the handle of the knife, being used to separate the parts, the edges of the sterno-hyoid and thyroid muscles are drawn to the mesial line. The thyroid body is drawn inwards and upwards. The recurrent laryngeal nerve lies between the œsophagus and trachea on the left side, so that (and more especially when the œsophagus is distended by a foreign body) it is necessary to draw aside or avoid the nerve, and open into the œsophagus, where there are no nervous filaments upon it. The inferior thyroid artery, which passes up to the lower angle of the thyroid body, should also be carefully avoided, as well as its branches. The sheath of the carotid artery, of course, should never be opened, but merely drawn aside. When the foreign body distends the œsophagus, it is

more easily cut down upon ; but, as a precaution, a probang, or metallic sound, should always be held in contact with it. From want of attention to this simple precaution, I have seen a surgeon cut upon the cricoid cartilage, and open the air-passages, which caused a very disagreeable complication. The omo-hyoid muscle, if in the way, should be divided. The œsophageal swelling, caused by the foreign body or probang, is readily recognised, but the operator should dissect carefully, lest the recurrent laryngeal nerve or the inferior thyroid artery should be between him and the œsophagus. The longitudinal fibres of the œsophagus being recognised, the knife is passed through the mucous membrane, and the finger introduced into the œsophagus. The opening need not be large, as the muscular fibres dilate readily. A tube is then passed by the nostril into the stomach, and retained, to enable the patient to be fed, until the wound in the œsophagus has healed.

The Diseases of the Pharynx and Œsophagus, to which I would direct your attention as coming within the domain of Surgery, are Pharyngeal Abscess and the different forms of Stricture of the Œsophagus.

PHARYNGEAL ABSCESES are either *lateral* or *posterior*. Lateral pharyngeal abscesses are those circumscribed abscesses which occupy one side of the pharynx only, immediately behind the tonsil. They are very difficult to diagnose, and may be mistaken for aneurism of the internal carotid artery, and *vice versâ*. They project inwards towards the mucous surface, and there is often a feeling of pulsation from the close proximity of the abscess to the large vessels of the neck. The history of the case may guide us. Such abscesses generally occur in rheumatic patients, and there are pains in the neck and about the back of the ear, which are premonitory of a pharyngeal abscess forming ; and so far these symptoms are diagnostic, but still they are not sufficient. In some cases I have been able to make sure of the disease by passing two fingers into the mouth, so as to let them rest upon the surface of the swelling, and in this way we can sometimes feel whether it is the pulsation of an aneurism or

merely the communicated pulsation from the carotid vessels : still the diagnosis is very difficult. In opening a lateral pharyngeal abscess there is danger of opening into the blood-vessels. We must be careful to turn the edge of the knife inwards here, and we should open the abscess as near the middle line as possible.

THE POSTERIOR OR RETRO-PHARYNGEAL ABSCESS is usually diffuse, and occupies the whole of the back part of the pharynx, and bulges forwards. It is very generally connected with disease of the bodies of the vertebræ. Even when this exists, where the abscess is threatening to cause suffocation by pressing forwards, we must interfere and open it, and in doing so we must be very careful. It is not a difficult thing to do with a bistoury wrapped round with lint, but if we open the abscess suddenly, especially when it is overhanging the larynx, suffocation may occur, and I have known this to happen. The pus gushes out, runs down the larynx, and so chokes the patient. To obviate this, I would use a flat trocar, with a very sharp point, and perforate the abscess with this, so as to allow the fluid to come through the canula into the mouth. We may empty the abscess so far in this way, and then enlarge the incision with a probe-pointed bistoury, when the more fluid part of the pus has been got rid of. It is the sudden gush of matter at first that is apt to cause suffocation when the knife is used instead of the trocar.

STRICTURE OF THE ŒSOPHAGUS is not uncommon, and as in the case of other mucous canals, may be either simple or malignant. Spasmodic stricture also occurs more frequently in the œsophagus than in any other mucous canal. This is easily explained when we consider the powerful muscular structure of its walls. Hysterical women are most subject to spasmodic stricture. The surgeon must also keep in mind that aneurism of the thoracic aorta or of the innominate artery may obstruct the passage by lateral pressure, and he should examine carefully before passing instruments to explore the œsophagus.

In stricture of the œsophagus, there is difficulty in swallowing, and regurgitation of more or less of the food. Fluids are most readily swallowed, but should the stricture be very tight even these are rejected. There is uneasiness at some part of the œsophagus, and sometimes a pain is felt passing back from the sternum to the spine between the shoulders. The patient often complains of great irritation in the throat, and spits up tenacious mucus as if to clear the passage. If the stricture be low down, a pouch sometimes forms, and the food, after remaining for some hours, may be ejected in a semi-digested state. But I have seldom seen the simple stricture so low down as the cardiac extremity of the stomach.

Stricture of the œsophagus may be the result of a chronic affection of the mucous membrane, causing gradual constriction, or it may be due to the swallowing of an irritant or corrosive substance, which, after exciting inflammation, is followed by persistent narrowing of the canal. In either case, there is consolidation of the sub-mucous texture, and afterwards of the muscular tissue—the canal being ultimately constricted by an effusion of lymph and cicatricial contraction. The complete circular constriction is rarely seen. The stricture is more generally due to a puckering at one point in the circumference of the canal.

The diagnosis between the different forms of œsophageal contraction is most important. Sometimes spasmodic simulates organic stricture. The former is generally distinguished by its remissions and exacerbations, and by its frequent occurrence in females about the menstrual periods, and the almost constant presence of the symptom of the *globus hystericus*. In spasmodic stricture, the passage of a bougie, exciting muscular action, is apt to mislead, and therefore we use means to prevent spasm. If the patient be put under chloroform, and the large tube pass easily, the case is one of spasmodic contraction; but if the constriction still remain, it is organic, either simple or malignant. A patient labouring under organic stricture has generally a pinched and emaciated appearance, like a person who is suffering from slow starvation. The symptoms of malignant stricture occur more suddenly and progress more rapidly than in the

simple form. It is not so much a stricture, properly speaking, as a cancerous tumour filling up and leading to obstruction of the œsophagus. It is usually placed either opposite the manubrium of the sternum or close to the cardiac end of the stomach, and is more common in the latter position.

Should the history and appearance of the patient point to malignant disease, instrumental interference is useless and hurtful. The occasional passage of bougies or the tube, may be required to introduce food, but their continued regular passage, as in simple stricture, for the purpose of dilatation, not only excites the disease to greater activity, but often causes serious hæmorrhage. The treatment is wholly palliative. To perform gastrotomy in such cases would be absurd, and would bring little credit to surgery. In one patient attending the hospital just now, with malignant disease at the cardiac extremity of the stomach, it is curious that the passage of an instrument relieves rather than excites the disease.

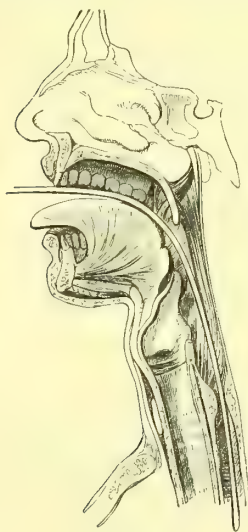


Fig. 33.

Simple organic stricture is treated by the passage of bougies, and if necessary, a tube to introduce food into the stomach. The bougie should be of gum-elastic, and should be allowed to remain in for a few minutes. The size should be gradually increased every four days, unless this excites too much irritation.

The irritation at first caused by the instrument ceases as the stricture dilates. The process of dilatation must be a gradual one, and therefore bougies should not be passed too frequently. After the dilatation has been fully accomplished, it is advisable to pass a bougie occasionally to prevent risk of recurrence of the contraction.

CLINICAL CASES.

FACIAL AND CERVICAL REGIONS.

CASE OF EXCISION OF THE LOWER JAW, IN WHICH BOTH LATERAL PORTIONS OF THE BONE HAVE BEEN REMOVED, LEAVING MERELY A SMALL PORTION AT THE SYMPHYSIS.—*Ed. Med. and Surg. Journal*, 1843.

My principal reason for publishing the following case is, that it is the only one, as far as I am aware, in which both lateral portions of the inferior maxilla have been removed, leaving merely the symphysis of the bone remaining, and hence I considered it might be interesting to the profession.

The first operation on the patient whose case is the subject of the communication, was performed by Mr. Fergusson (now Sir William Fergusson) in 1836 ; and, through the kindness of that gentleman, I am enabled to commence the history of the case with his report.

“ Mrs. Fitzpatrick, aged 46, received a blow on the right side of the lower jaw several years ago, and since then various small portions of bone have been discharged from time to time. A tumour has gradually formed on the bone between the angle and the chin, and has since attained the size of a hen’s egg, its growth having increased rapidly within the last five months. There is no particular pain in the part, but it now begins to annoy her from its size. On the left side the alveolar processes are somewhat thickened, and the teeth on both sides are very deficient, only a few stumps remaining.

“ With the concurrence of Sir George Ballingall, Mr. Nasmyth, and others, I removed the tumour on the right side on the 12th of March 1836, having divided the bone behind and a little above the angle, and in front a little anterior to the mental foramen. The wound healed kindly, and a firm cicatrix formed in the mouth between the divided ends of the maxilla. I used occasionally to see this patient afterwards, and observed that the swelling on the other side was gradually increasing. Several sections were made of the part which had been removed, and each surface presented a smooth, dense aspect of a homogeneous character throughout. The deposit of new structure had seemingly taken place between the alveoli and the maxillary canal, as the latter part had been pushed downwards until it had reached the external plate of bone on the lower margin of the jaw. There was no soft point in the growth, and

nothing to indicate malignancy." Such is Mr. Fergusson's history of the patient whilst under his care.

I first examined this patient in August last, at the request of Mr. Lawrie, to whom she had applied for advice. She at that time complained of great pain in the remaining portion of the jaw, a little in front of the angle of the bone, and on examination, a hard tumour, about the size of a large walnut, flattened, could be felt situated in front of the angle of the jaw.

Her own history of the disease was similar to that given by Mr. Fergusson, except that she stated that a piece of bone had been discharged from the left as well as from the right side of the jaw, and that the tumour for which she now consulted me had existed for about five years before the former operation was performed. As she stated that the tumour was enlarging, that the pain had of late become more violent, and as her health was sinking from the want of rest and continued suffering; and as, judging from the firm feel and previous history of the tumour, it did not seem malignant, I recommended her to have it removed. To this, however, she could not then make up her mind to submit. In the end of September I was again requested to see her, when the pain had become so violent that she said she would submit to anything that would relieve her. I showed the case to Sir George Ballingall, Professor Syme, and Mr. Nasmyth, and these gentlemen coincided with me in recommending an operation.

I performed the operation on the 20th of October last (1842), in presence of Sir George Ballingall and several medical friends, and assisted by Drs. Handyside, Duncan, and Mr. Nasmyth. Entering the bistoury in front of the insertion of the masseter muscle, I transfixed the membrane of the mouth, carried the knife forward along the bone and cut outwards, dividing the prolabium and other soft parts a little to the left of the symphysis, and thus at once formed a flap which laid bare the tumour, and enabled me to apply the saw to it. Having ascertained its nature, and finding that its entire removal was necessary, I made an incision downwards from over the articulation of the jaw, terminating in the external end of the former incision. The semilunar flap so formed was then dissected up, the bone cleared from the soft parts on its inner surface, and sawn in front of the canine tooth. I then depressed the bone so as to enable me to divide the insertion of the temporal muscle, and completed the operation by disarticulating the lateral portion of the jaw; five arteries were tied, some slips of lint placed in the deep part of the wound, and the edges of the incision were then brought together by some points of interrupted suture, except at one point midway between the ear and chin, which was left open for the ends of the ligatures to hang out.

Everything proceeded favourably; the external incision healed by the first intention except where the ligatures hung out. The slips of lint were removed from the deep incision on the third, and the patient was sitting up on the ninth day. The last ligature came away on the twelfth day. This ligature had been brought out at the upper part of the incision in front of the ear, and on its separation saliva continued to flow from the opening for some days, but it soon healed under the use of pressure, by means of a compress of lint applied over the fistulous opening.

Remarks.—It may seem at first sight of little use to leave the mere symphysis remaining, as, when deprived of the support of the lateral portions, it was as likely to be retracted along with the tongue as to prevent that occurrence. The reasons which induced me to leave that portion of the bone were—*1st*, That it would afford a better hold for the gentleman who assisted me, to prevent retraction during the operation ; *2dly*, That when the wound healed it would afford support to the lower lip, and thus in some measure prevent the constant escape of saliva ; and that as it would contract adhesions to the cicatrix, by preserving the attachments of the muscles of the tongue, the patient would be enabled to speak and swallow better than if it had been removed ; and, *lastly*, By preserving somewhat the appearance of the chin, the operation would be followed by less deformity, and the patient rendered more comfortable ; whereas, if the symphysis had been removed, the retraction of the lower part of the face would have been greater, the tongue would have formed adhesions to the fore-part of the lip, and thus, from its pendulous position, have given rise to a constant and profuse discharge of saliva, as was the case in the patient mentioned by Sir George Ballingall, and speech would necessarily have been very indistinct.

The result of the case has fully justified these conclusions : there has been no violent retraction of the tongue ; the patient is able to speak as well as before the operation ; she swallows easily, can shut and open the mouth, and protrude and retract the tongue readily. The escape of saliva when sitting up is very trifling, and is gradually becoming less.

A section of the jaw, made by my friend Mr. Goodsir, shows the tumour to be of a dense solid structure except in its centre, where soft degeneration was apparently just commencing.

The woman lived for fourteen years after the operation, and had a certain amount of power of chewing with the front teeth, so that she could eat animal food. On examination after her death, I found that the space on each side of the symphysis, from which the jaw had been removed, was occupied by a very dense

structure into which massetic and internal pterygoid muscles were attached.

MALIGNANT TUMOUR OF RIGHT SUPERIOR MAXILLA.

Susan W., æt. 41, unmarried. Admitted to Ward XIX. March 8th, 1865.

Patient caught cold last Christmas, and first noticed a swelling of the cheek a few days later. She rubbed the cheek with some liniment, but the tumour continued steadily to increase. Accordingly, three weeks ago, she consulted a medical man in Glasgow, who incised the swelling, and removed a portion of it. It then disappeared, but quickly attained its former size.

She had been perfectly healthy, but since the appearance of the tumour she has lost both strength and appetite.

On examination, a tumour of the size of an orange, of firm consistence, is found to occupy the right superior maxilla. It involves the whole of that bone, and extends across the hard palate. The right nostril is almost completely occluded.

The superficial veins are dilated over the tumour; the skin and soft tissues of the cheek everywhere firmly adherent to the tumour. Patient suffers great pain. The neighbouring glands are not affected. The lungs and heart are found to be healthy.

March 12th.—Had smart hæmorrhage from the right nostril this morning.

13th.—Considerable diarrhœa during the night. P. 100, weak. No recurrence of hæmorrhage.

14th.—Slept well after an opiate. P. 100, weak.

15th.—To-day Professor Spence removed the tumour. He made a horizontal incision from the angle of the mouth. Then he made an incision from the inner canthus, joining the first. A third incision was made from the inner angle of the eye to the corner of the mouth, so as to remove all the soft parts implicated in the disease. The flap was dissected off, and the bone sawn through at the outer and inner angles of the orbit. The soft tissues of the mouth were divided on the hard palate, beyond the seat of disease. The alveolar process was then sawn through, and the other connections of the bone divided with cutting-pliers. Part of the septum nasi and the palatal process of the left upper maxilla were removed. A few vessels in the cheek required ligature. The gap left by the removal of the tumour and textures of the cheek was carried from the angle of the mouth downwards and outwards for about three inches below the lower jaw, and curved backwards in the neck, so as to shape a somewhat triangular flap, which was dissected, and brought up to form a new cheek. The soft tissues were brought together with sutures, except a small portion below the lower jaw, which part was left to granulate. P. 140 after the operation. A full opiate was given, and an enema of beef-tea and brandy. To have wine and water at intervals.

Vesp.—P. 96, strong. Has slept well. No pain and no oozing.

16th.—P. 100, good strength. Slept well without an opiate. Slight redness about the edges of the wound. To have no stimulants. To have beef-tea, arrowroot, etc.

Vesp.—P. 120, fair strength. Ordered a compound colocynth pill.

17th.—Still some redness about the wound. Some points of suture removed. P. 120.

19th.—P. 90. Flaps yielding at corners of mouth and eye.

20th.—Had a severe rigor at 12.30. Given brandy and morphia and hot bottles applied.

22d.—Ligatures came away. P. 95.

24th.—Wound kept together by plasters.

April 5th.—P. 75, strong.—Going on most favourably.

8th.—Sat up to-day.

23d.—Wound all but healed. Walks about the ward.

30th.—Sent to Convalescent House.

CASE OF ENORMOUS DEEP-SEATED TUMOUR OF THE FACE AND NECK, SUCCESSFULLY REMOVED BY OPERATION.

In the beginning of October 1862, I received a letter from Dr. Phipps, of Manchester, in reference to the patient whose case I am about to narrate. He gave me the general history of her case ; and enclosed three photographic portraits, exhibiting a tumour from different points of view ; and requested me to say whether I thought there was any possibility of removing it, as she was willing to run any risk to have it removed. The history of her case was as follows :—

Mrs. Jepson, aged thirty-four, of a healthy appearance, states that, when eighteen years old she noticed what she calls a “waxen kernel,” growing under the skin over the mastoid process of the right side, and immediately under the lobule of the ear. For two years it showed no tendency to grow larger, but afterwards it increased slowly ; and she applied for relief to several medical men. In spite of the use of iodine, externally and internally, it continued to grow. She was married when she was twenty-one years of age ; and states that during her pregnancies the tumour appeared to increase more rapidly than at other times. Four years after her marriage the growth had reached the size of a large hen’s egg ; and she was taken by her medical attendant to the Manchester Infirmary, to obtain the advice of the surgeons of that institution. They told her that the tumour might be removed ; but that she must take the whole risk of the operation on herself. Her own medical attendant seems to have dissuaded her from having anything done. Since then the tumour has continued gradually enlarging ; but of late years has shown a marked tendency to more rapid increase.

I was informed that the patient, harassed by the weight and deformity of the tumour, had recently applied to a surgeon at Manchester to have it removed ; but he declined interfering, and dissuaded her from sub-

mitting to any operation. I wrote, in reply to Dr. Phipps, that though I could not decide without personally examining the patient, I was inclined, from the history he gave of the growth, and his account of its general relations, to think it might be removed, and that I would arrange for her reception under my care if she came to Edinburgh, as contemplated. She was admitted into my wards in the Royal Infirmary, on the 11th November 1862.

Appearances on Admission.—The patient is a somewhat pale, but not cachectic-looking woman. There is an enormous tumour, as large as her head, projecting from the right side of her neck. Its boundaries are the following :—Beginning about one inch from the second cervical vertebra, it passes downwards to within an inch and a half of the clavicle ; then sweeps obliquely to the middle line of the neck, which it reaches near the cricoid cartilage. It then passes upwards by the side of the chin, close by the angle of the mouth—which is not distorted ; and round by the outer angle of the orbit, and through the lower part of the temporal region, and thence to the spinal column, on a level with the meatus auditorius externus and apex of the mastoid process. The lobule of the ear is very considerably stretched. The surface of the tumour is irregular, presenting a lobulated appearance ; the most prominent part is that which projects forwards from the face, and where there is a feeling of fluctuation ; the rest of it is solid. The veins over the surface are not markedly distended. The anterior portion of the tumour is more movable than the posterior. There is no glandular enlargement, either in the subclavian space or on the left side of the neck. Respiration and deglutition are not in the least interfered with.

November 18th.—Since the 16th instant she has been very sick, with occasional vomiting ; but to-day she feels much better. The sickness is almost entirely gone, but the fauces are inflamed. Pulse 92.

November 21st.—The throat is still inflamed ; otherwise she feels better.

Operation.—On the 3d of December, Mrs. Jepson having quite recovered from the feverish attack from which she suffered after her admission into the hospital, I proceeded to remove the tumour. The patient having been placed recumbent, and brought under the influence of chloroform—her head and shoulders supported with pillows, and her face turned towards the left side, I commenced the operation by making two slightly curved incisions, extending from the lobe of the ear to the sternal attachment of the sterno-mastoid muscle, so as to mark out an elliptical portion of skin, about three and a half inches broad at its widest part, over the middle and prominent part of the tumour—the anterior incision corresponding nearly to the internal edge of the mastoid muscle. I next made an incision backwards and slightly downwards from the middle of the posterior longitudinal incision, so as to extend beyond the posterior limit of the tumour ; and lastly, an incision from a point external to the angle of the mouth, was carried obliquely downwards and outwards, so as to fall upon the centre of the anterior longitudinal incision. The four large flaps of skin and platysma myoides thus marked out were then dissected and reflected off the tumour, commencing with the posterior—the external jugular vein being tied with two ligatures, and divided between

them. When the whole surface of the enormous growth was thus exposed—except where the elliptical portion of skin remained—the sterno-mastoid was seen to be so attached to the tumour about its middle, that I divided it above and below that part. I then relieved the anterior margins of the cervical portion by a careful dissection, keeping the edge of the knife towards the tumour until I was fairly beyond the line of the great vessels. My dissection was continued from the lower and posterior part till the phrenic nerve was seen clearly, and the upper and posterior portion, which had been previously so far relieved, was then rapidly detached from its deep connections, and the whole of the cervical mass of the tumour was free. The detachment of the facial and parotid portion still remained to be accomplished ; and this required great care, both because that part of the tumour seemed more cystic, and also because, as I expected, it was deeply connected behind the ramus of the jaw. On dissecting it from before, downwards and backwards, I found it attached to the facial covering of the posterior belly of the digastric muscle, so that I had to dissect the muscular fibres. Above, it dipped deeply between the mastoid process and the jaw ; but, partly with the finger and careful dissection with the knife, it was detached pretty easily, till I arrived at the attachment under the ear over the mastoid process. Here it was firmly adherent, and the weight of the tumour caused a slight tear of its substance ; but by having the tumour supported, I dissected this attachment carefully, so as to remove the whole tumour entire. A large vessel entered it at this point, which was readily secured. During the operation some arteries which bled were tied as cut ; and also some large veins, previous to their division. The chief bleeding during the operation was venous, from the divided veins passing from the tumour ; but the whole amount of blood lost certainly did not amount to eight ounces. The wound resulting from this dissection when the tumour was removed, extended from the zygoma to the clavicle and sterno-clavicular articulation. In the facial portion, the parotid gland seemed either atrophied, or so displaced that nothing was to be seen of it in the deep space between the jaw and the mastoid process. The portio dura—the cervico-facial portion of which had been unavoidably cut—was seen crossing to the face ; and the external carotid could be felt pulsating ; and the digastric was seen dissected here. In the cervical portion of the wound, the great internal jugular, and its tributary veins, and the carotid artery, were exposed for nearly their whole length, and posteriorly, the phrenic nerve was seen lying on the anterior scalenus. The flaps were brought together by a few points of suture, and seemed to be rather redundant, notwithstanding the elliptical portion of skin removed. A flat fold of lint was placed lightly over the wound.

During the operation the chloroform caused vomiting. The patient was carried to bed ; hot-water bottles were applied to the feet, and a brandy enema given.

Dec. 4th.—Slept tolerably well during the night ; sickness pretty severe ; ordered brandy and ice ; pulse 128.

Dec. 5th.—Pulse 130 ; slept pretty well ; has taken a little food ; the facial nerve seems slightly affected ; she feels very little pain in the wound.

Dec. 6th.—Pulse 96 ; several stitches removed.

Dec. 8th.—Pulse 98 ; slept better than she has done since the operation ; the lower angle of one of the flaps showing a tendency to inversion, a piece of lint was introduced below it, and the wound dressed with a solution of chloride of soda.

Dec. 9th.—Wound discharging freely ; continue dressing ; affection of the facial nerve not so marked ; pulse 96.

Dec. 10th.—Still improving ; had a very refreshing sleep last night ; taking her food well ; pulse 92.

Dec. 15th.—Wound looking well ; dressed with a solution of chloride of soda ; taking food well ; sleeping well, and not complaining of pain ; has been sitting up a little occasionally since last report ; pulse 84.

Dec. 17th.—Still improving in every respect ; pulse 84.

Dec. 20th.—Wound still discharging freely ; appetite good ; pulse normal ; ligatures came away to-day at dressing.

Dec. 23d.—Yesterday she became sick, and vomited several times after dinner ; sickness continued occasionally during the night ; this morning she is not nearly so sick as the day before ; the wound presents the appearance of grey phagedæna, with erysipelatous blush on the skin ; touched it lightly with nitric acid ; tongue whitish ; pulse 112.

Dec. 24th.—Sickness entirely gone ; the wound rather dusky-looking ; the surface touched slightly with nitric acid.

Dec. 25th.—The wound has much the same appearance as it had yesterday ; continue treatment ; pulse 96.

Jan. 6th.—Since last report she has been improving very satisfactorily ; this morning she walked from Ward XX., where she has been lying temporarily, to her old quarters in the private ward ; the wound is looking well, and the tongue clean ; and the pulse is 88.

Jan. 12th.—Is much improved ; sat up for an hour yesterday ; the wound is healing rapidly.

Feb. 3d.—Since last report the patient has gone on improving daily ; the wound is now almost entirely healed ; and she left the hospital to-day for the Convalescent House.

After remaining for some weeks in the Convalescent House till the cure was completed, Mrs. Jepson returned to her home at Over-Darwen, Lancashire ; and since her return I have heard frequently, both from herself and also from Dr. Phipps, who states that her health is good and her appearance gradually improving ; the marks of the cicatrix becoming less evident.

Examination of the Tumour after its Removal.—The growth was of a very irregular form, but may be described as an irregular ovoid mass, $9\frac{1}{2}$ inches in length, $8\frac{3}{4}$ inches at broadest part ; its thickness or projection $7\frac{3}{4}$ inches, and weighing rather more than 7 pounds. It was nodulated on its surface, some of the larger projections looking like cysts, and feeling soft to the touch. The whole growth, however, was composed of solid matter, and presented, on section, the characters of the fibro-cartilaginous form of fibrous tumours. A careful examination of its structure was made by my friend Dr. Haldane, who has favoured me with the following description of it :—

"On section, the mass was found to consist of two kinds of material ; the most abundant, and that which formed the basis and the greater part of the tumour, was of a glistening appearance, a pale bluish-white colour, and was of firm almost cartilaginous consistence. Mixed with this and occurring generally in bands, but sometimes in small patches, was a softer and more friable matter, of a pale opaque yellow colour. A few small masses of a glistening yellow appearance, evidently consisting of fat, were scattered through the mass.

"On microscopic examination the firm glistening portion of the tumour was found to consist of a finely fibrillated structure, in which were embedded oval, rounded, or elongated nucleated cells, having all the characters of cartilage-cells : these varied in abundance in different parts, being, in some places, as numerous as the cells in true cartilage, in others but sparsely disseminated. The yellowish opaque matter consisted of granular material and small cells, apparently in process of disintegration ; they resembled tubercle corpuscles or shrivelled pus-cells, but were somewhat larger ; they contained no nucleus, but, in many, one or more granules were seen. The matter, which to the naked eye seemed fatty, was proved to be so on microscopic examination."

Remarks.—The case just detailed seemed to me worthy of notice on account of the great size of the tumour, its important anatomical relations, and the formidable character of the operation required for its removal ; but especially as giving encouragement for surgical interference in similar cases of deep-seated cervical tumours, and as indicating certain principles, both in regard to the kind of growths suitable for operation, and the points to be attended to in effecting their removal.

Operations for the removal of large tumours from the neck are always attended with great danger from the proximity of the numerous important structures in that region, and the impossibility of thoroughly commanding the circulation through the great vessels during the operation. Large tumours, arising in the parotid and passing into the cervical region, have been frequently removed when placed superficially to the sterno-mastoid muscle. But some surgical authorities regard cases of tumours developed beneath that muscle as unsuitable for removal by operation ; and, in point of fact, few if any cases of complete and successful removal of such tumours are recorded ; at least, after some research, I can only find four cases mentioned :—One by Mr. John Bell in his work on Surgery, vol. iii. ; two by Professor Warren of Boston, in his work on Tumours ; and one in

cidentally mentioned by Mr. Liston in his *Practical Surgery*. Of the three first-mentioned only, are the details given, and in none of them was the whole tumour removed. Mr. Bell, who describes the operation in his usual graphic style, confesses that he left some small roots of the tumour attached to the transverse processes of the vertebræ for fear of injuring the phrenic nerve. The tumour rapidly recurred, and destroyed the patient. In one of Mr. Warren's cases, only portions of the growth could be removed, as it involved all the textures intimately; and, after ligature of both the carotid artery and internal jugular vein, a large mass was left, being connected with and projecting into the pharynx. In his second case, Professor Warren, after clearing the surface of the tumour, rather than divide the sternomastoid for fear of injuring the spinal accessory, "the consequences of which last I was unacquainted with," adopted the alternative of cleaving the mass perpendicularly in its long axis, so as to remove the two halves from under the muscle; and here, again, he tied and divided both the carotid and internal jugular; but some parts of the tumour in front of the vertebræ were left, the actual cautery being applied to them. The details of the case subsequent to the operation are meagre; very grave symptoms appear to have followed immediately, but the patient seems to have rallied; and, though we are led to infer that he did recover, nothing is said of the ultimate result, or whether the tumour was reproduced or not. The only notice of Mr. Liston's case I can find, is contained in *Practical Surgery*, chap. v., "On the Injuries and Diseases of Muscles and Tendons." He says:—"I had occasion to remove the sterno-mastoid muscle of one side, involved in a sarcomatous tumour, from its origin to its insertion—a growth to which the most fastidious critic will not refuse the term sarcoma; though, in all probability, the muscular fibres may have been involved secondarily. The tumour was, so far, limited by a cellular sheath, yet the dissection was difficult and extensive. The patient made a good recovery, and no malposition of the head followed." *

* Since writing the above, I have found in one of the Journals of the Royal

So far as I could judge from this brief account of Mr. Liston's case, it seemed a growth developed in the substance of the mastoid, surrounded by the fascial sheath of the muscle ; and, if so, differing very much from the enormous and irregular tumour I had to deal with. The cases recorded by Bell and Warren, though not successful in complete removal of the tumours, possessed this element of encouragement, that, whilst the failure depended on the character of the growth being unsuitable for any operation, they showed how much could be effected even under unfavourable circumstances, and so led me to infer that if the character of the growth were suitable, the difficulty of the operation need not be an obstacle to its performance.

In determining the propriety of operative interference in Mrs Jepson's case, it seemed to me that the points principally to be considered were :—1st. The character of the tumour ; whether simple or malignant ? 2d. The probable result, if the growth were left to itself ? 3d. How far its enormous size, anatomical relations, and possible connections with vitally important parts, might endanger life, or prevent its complete removal ?

Correct diagnosis as to the character of the growth is most important in deciding on the question of operation in all cases of tumour, as involving the probability of future immunity from the recurrence of the disease. But in the case of large tumours in the vicinity of important organs, it is also important as to the question of immediate danger to life in the operation. In my surgical lectures I have always dwelt upon the limitation of simple, as compared with malignant tumours, as a principle of great practical value. In simple growths, important organs—such as great vessels and nerves—may be pressed upon, pushed aside, or even surrounded by the tumour or its lobules ; but the

Infirmary for 1834, the report of a case of large cervical tumour, operated on by Mr. Liston. The tumour, which occupied nearly the same position as the cervical portion of my patient's tumour, had grown rapidly in about two years. In this case Mr. Liston found it impossible to remove the whole growth by the knife, and the part near the vertebræ was strangulated by ligatures passed through its base. The patient recovered at the time.—J. S.

cellular sheaths are not destroyed ; and even if the growth has formed adhesions to the sheath, the vessels themselves are free ; whereas in malignant growths we find no such limitation. On the contrary, the disease often invades all the textures, destroying the cellular sheaths, and involving the vessels and nerves themselves ; and even when the mass of such a tumour is enclosed in a dense cyst, and apparently movable, it is not truly limited ; but the narrow prolongations of the diseased structure dip deeply amongst the textures, and form such connections as to defy any certainty of complete removal, as happened in the cases recorded by J. Bell and Warren, already referred to.

In the case of Mrs. Jepson, the originally slow progress of the growth, the comparatively unimpaired state of her general health, together with the appearance of the tumour and the absence of that anxious expression of countenance which marks most cases of malignant cachexy, were all conditions indicative of the simple character of the growth ; whilst the more rapid increase latterly noticed, though a reason for interference, was only what we find in most tumours, however benign, and depends on the enlargement of their vessels, and consequent increase of nutritive supply. So far, then, as the character of the growth was concerned, there was everything in favour of operation, as the tumour was neither likely to involve the neighbouring textures nor liable to recur after removal.

The second consideration was, the probable progress of the tumour if left to itself. As yet, neither respiration, deglutition, nor any vital function, had been affected by the growth ; but then it had, of late, begun to increase more rapidly in bulk, and over the most prominent part the skin had a dusky red appearance, which showed a tendency to ulceration ; and when that once commences, even in simple tumours, we know how rapidly they fungate, slough, and bleed—degenerating locally, and exhausting the patient by discharge and pain—and that their removal then becomes much more difficult and dangerous. Besides, the nutrition of the growth was evidently carried on at the expense of the patient's general health ; for, though not

cachectic, she had become pale, and felt more feeble than formerly ; whilst the enormous bulk and weight, together with the increasing deformity, rendered her almost unfit for any duty, and gave rise to great mental depression, so that she was most anxious to have the tumour removed at all hazards. The consideration of these first two questions resulted in a decision favourable to operative interference. It now remained to consider how far the size and connections of the tumour admitted of removal by operation without immediate risk to the patient's life ; and to plan the procedure by which this could be most readily and safely effected. The great bulk of a tumour, though always a source of risk, from the extensive incisions requisite for its removal, the amount of surface exposed, and the proportional hæmorrhage, venous and arterial, does not necessarily render the operation more difficult ; on the contrary, the very size gives a power of leverage which often facilitates the dissection. But when the mass is so situated as to present a large surface, it may be adherent to, or in close connection with vitally important parts, then the operation required for its removal becomes most formidable. These elements of difficulty and danger were present to their fullest extent in my patient's case ; for, besides the enormous bulk of the tumour, it was developed beneath the sterno-mastoid, and its deep surface was necessarily in the closest relation with the great vessels and important nerves in the cervical region, from the lower jaw to within an inch of the sternum, and stretching backwards to the margin of the trapezius muscle ; whilst the facial portion felt fixed in the parotid region, as if deeply niched behind the ramus of the jaw ; and it could be felt projecting towards the fauces within the mouth. The bulk, form, and position of the tumour rendered it impossible to ascertain positively whether or not it adhered at any point to the sheath of the vessels ; and the apparent mobility of a large cervical growth can never altogether be depended on ; for, even if it involve or be adherent to the vessels or their sheath, these, being loosely connected, move with the tumour on the more fixed parts. But in the face of these risks

I felt warranted to operate, on the following grounds :—First, as I have already said, the simple character of the tumour made me feel secure that, though it might displace, press upon, or even adhere to the sheath of the great vessels and nerves, it would not absolutely involve them. Secondly, the absence of any engorgement of the great veins of the neck on either side, or of any marked alteration in the arterial supply of the right side of the face, made me pretty sure that neither the internal jugular nor the carotid could be very closely or extensively involved ; whilst the functions of respiration and deglutition being unimpaired, and no symptom of laryngeal irritation existing, rendered it equally clear that neither the vagus nerve, its branches, nor the phrenic, were as yet implicated.

Having thus satisfied myself that the tumour might be removed by an operation properly planned, and carefully and deliberately executed, I proceeded to determine the method by which it could be most readily and safely accomplished. The dangers to be apprehended were—Hæmorrhage from the arteries supplying the tumour, or, more likely, from the great veins returning the blood from it ; the risk of air entering any of these large veins when divided ; the risk of injury to the vagus or phrenic nerves ; and the probability of meeting difficulty from adhesion of parts in the parotid region, where the tumour felt fixed ; lastly, exhaustion of the patient from the necessarily tedious dissection and large exposed surface. To obviate these dangers as far as possible, I determined to expose freely the whole surface of the tumour ; to clear its edges ; and, in doing this, to expose the anterior margin of the sterno-mastoid muscle, at the lower part of neck, so as to be able, if necessary, to compress the carotid ; next, to divide the sterno-mastoid above and below, so as to leave the part adherent to the growth ; to tie the external jugular with two ligatures, and divide it between them ; and to pursue the same course in regard to all the larger veins passing towards the jugular or root of the neck, and to secure the larger arterial branches as divided. Ligature of the lower part of the common carotid, as a preliminary, with a view of

diminishing loss of blood—which has been advised and adopted in the removal of tumours from the neck and face—I rejected as worse than useless, as not only incurring unnecessary risk to the patient, but as likely to lead to danger by inducing a false security in the operator, as its ligature could not control the retrograde hæmorrhage from the free anastomosis superiorly ; whilst the free incision along the sterno-mastoid enables the assistant to control the carotid trunk quite as effectually, should it be necessary. Besides, in such a dissection, wound of the great internal jugular vein is much more likely to occur than injury of the carotid ; and the best means of avoiding either is to disturb the natural relations of the vessels as little as possible, and to dissect with the edge of the knife directed towards the deep surface of the tumour, whilst the assistant insinuates his fingers in the track of the dissection, so as to protect the vessels. I decided, after clearing the tumour from the great vessels, to dissect the rest of the cervical portion from below upwards, so as to avoid injury to the phrenic nerve : and then to proceed with the dissection of the facial portion from above downwards and backwards, so as to leave the part which felt most fixed in the deep parotid region, and where I expected the largest vessels to enter the tumour, to the last. This plan I carried out, as detailed in the description of the operation, with the able assistance of my colleagues, Drs. Gillespie and Watson ; and I had the satisfaction of removing entirely this enormous tumour, and so relieving my patient from what she and her friends had long regarded as a hopeless disease.

In a letter I have received from Mrs. Jepson, dated October 8th, 1863, she says :—“ I am happy to inform you that I am in good health ; the scars do not look bad ; they are perfectly healed up, and gradually appear less.” When I last heard of her, about a year ago, she was quite well, had had two children, and remained free from any appearance of the tumour returning.

LARGE CERVICAL TUMOUR SUCCESSFULLY REMOVED.

The following is an example of the excision of a growth similar in character, though presenting some local peculiarities :—

George Manson, æt. 16, recommended to me by Dr. Grant Smith of Thurso, on account of a large cervical tumour, was admitted into the Royal Infirmary under my care on the 9th of June 1867.

On examination, the tumour, which was somewhat irregular in form, nodulated on the surface, and of a firm consistence, was found to occupy the whole of the left side of the neck. Commencing at a point close under the angle of the jaw, it passed beneath the sterno-mastoid muscle, and then projected towards the surface, extending back to and elevating the interior margin of the trapezius, and occupying the whole of the supra-scapular and subclavian regions of the neck, where it lay below the posterior belly of the omo-hyoid muscle. On the mesial side of the sterno-mastoid, the tumour projected inwards, pressing the larynx and trachea to the right side ; it bulged upwards to a level with the os hyoides, and below it dipped beneath the muscles in front of the trachea, and descended into the supra-sternal fossa. The growth seemed movable, and its margins were pretty well defined, except at the sternal region, where it appeared to pass deeply, and where the superimposed textures bound down its surface so as to prevent its connections from being so clearly ascertained as in other directions. It was not moved by the efforts of deglutition, but the position of the belly of the omo-hyoid was very distinctly seen over the posterior portion of the tumour during such efforts. The superficial veins of the left side of the neck were somewhat larger and more numerous than those of the opposite side. The history of the case showed that the tumour had been originally, and for many years, of slow growth. It was first noticed when the boy was three years of age, and increased little for the first eight or nine years ; but of late it had progressed more rapidly, especially during the last two years. There was no pain in the tumour, nor interference with deglutition, but for some months the breathing at night had become oppressed, and at times spasmodic. The lad's health was good ; there was no appearance of emaciation, and all the functions were natural.

The tumour was firm, and apparently solid throughout, and, as I have said, tolerably well defined. The youth and his friends were anxious that something should be attempted to relieve the increasing difficulty of breathing ; and on my stating that I thought the removal of the tumour advisable, they readily consented to the operation.

On the 12th of June I performed the operation for the removal of the tumour in the following manner :—I first made an incision along the course of the sterno-mastoid, from the angle of the jaw to beyond the sterno-clavicular articulation. Then at its lower termination I made a small transverse incision, about an inch and a half in length, so as to enable me to expose more fully the part where the tumour passed into

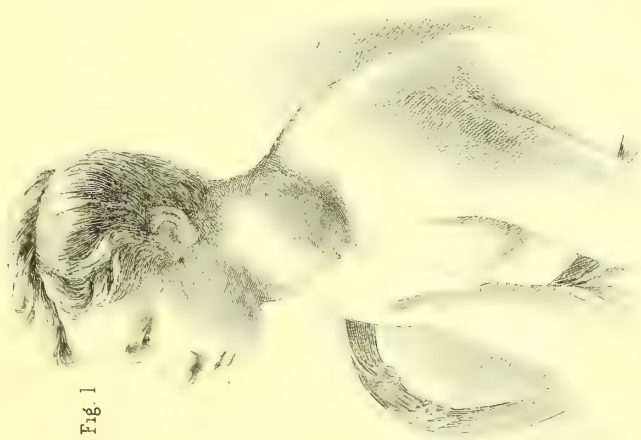


Fig 1



Fig 2



Fig 3



the sternal fossa. Lastly, I carried a third incision, four inches long, from the middle of the first incision backwards to the anterior margin of the trapezius. I then dissected the skin and platysma, so as to expose the anterior portion of the tumour as far inwards as the tracheal margin, which I cleared from the fascial covering, and elevated. Next, passing my finger beneath the fascia and the fibres of the omo-hyoid muscle, which were stretched over the growth at the lower part of the neck, I divided them, and had the satisfaction to find that the substernal portion was defined and unattached, and could be readily turned out. I now proceeded to clear the remainder of the tumour by dividing the sternomastoid transversely, and dissecting it and the other coverings off from the surface in two flaps, as marked out by the incisions. In doing this, some small superficial vessels were tied. On fully exposing the tumour, a large vein was seen on its surface at the upper part. This vein, though distended above, was obliterated where it lay over the lower part of the growth. The distended part of the vein I included in two ligatures, and divided it between them. The whole mass being now fully exposed, I proceeded to dissect it out from before backwards, feeling with my left forefinger for the vessels, so as to protect them from risk of injury. On clearing and raising outwards the anterior portion of the growth from its deep connections, the carotid artery and pneumogastric nerve were seen bare, as if dissected from their sheath, but the internal jugular vein could not be seen, and the pneumogastric lay somewhat in front of the carotid at its lower part. As I could neither see nor feel anything of the internal jugular, I next dissected the tumour from its posterior aspect, and then from the subclavian space, cutting with the edge of the knife close towards the deep surface of the tumour, so as to avoid the phrenic and sympathetic nerves and the thoracic duct in the deep dissection at the inferior region of the neck. At one part the tumour was closely adherent to the fascia over the upper part of the scalenus anticus, but by dissecting the fascia from the muscle the whole growth was removed entire.

The parts now represented a deep dissection of the whole side of the neck, but no trace of the internal jugular vein in its natural relation could be seen, and it was concluded that the vein tied on the surface of the tumour was the jugular. There was very little bleeding, only a few small arteries requiring to be tied; but the last touch of the knife, separating the tumour, divided a small vein, which retracted between the transverse processes of the vertebræ, and as it could not be seized, the troublesome oozing from it required to be arrested by pressure. The surface of the wound was painted over with tincture of iodine, and the integuments were replaced and united by sutures, except at the posterior angle of the transverse incision, which was left open to permit any discharge to escape, a compress of sponge supported by a bandage being placed over the wound to prevent venous oozing. The patient was then removed to the ward and placed in bed, his head properly supported. In the evening, some recurrence of bleeding necessitated opening the posterior part of wound. The bleeding was found to proceed from a small artery, which was tied. No further bleeding from the vein had taken place, and the wound was finally closed with sutures.

On the 13th the patient was pretty well. Pulse 100. Some nausea from chloroform. Ordered a saline aperient mixture.

14th.—Free from sickness ; bowels have acted freely ; tongue clean ; skin cool. Pulse 90.

15th.—Continues doing well. Pulse 84.

16th.—Pulse 76. Most of the stitches removed.

17th.—Incision along sterno-mastoid entirely united, as also the small incision at sternum. A good deal of healthy discharge from the transverse incision. Pulse 80.

20th.—Pulse 64. All ligatures except two have come away. Slight pressure with strapping to be applied over the corner of wound, near the ear, where pus has a tendency to lodge. Wound dressed with weak solution of tincture of iodine in water. From this time the patient's progress to recovery was uninterrupted. On 31st July the wound was healed throughout, except the surface of the cicatrix ; he was able to be out of bed and walking through the ward with the head unsupported ; and he was dismissed from hospital on the 24th of August.

The photograph showing the recently cicatrised wound left after removal of the tumour was taken on the 2^d of August. (See Plate 48.)

Examination of the Tumour.—The tumour, which presented an irregular nodulated surface, was of somewhat ovoid shape, broader below than above, and of a uniformly firm consistence. On making a longitudinal section, it presented much the appearance of the section of a gland mixed with fibrous texture ; and, on more minute examination, it had all the usual characters of the adenoid growth. About the centre of the section, two small portions had a dark bloody colour, and felt softer than the rest of the growth ; but, on careful examination, they were found to be essentially of the same structure as the rest of the tumour.

Commentary.—In my memoir of Mrs. Jepson's case, I adverted to the want of success which has hitherto attended operations for the removal of such deep-seated cervical tumours, as I could find no record at that time of any case in which a large tumour situated under the sterno-mastoid had been completely removed, with ultimate success ; none, indeed, where complete removal had been effected. As it seemed to me that this want of success had led some surgeons to express strong opinions against operations for the removal of deep-seated cervical growths, I stated my opinion that the certainty of complete and safe removal of such tumours depended on the selection of proper cases for operation, by careful attention to the history of the case, and to the diagnosis of the character of the growth ; for if the tumour was of slow growth and simple character, we could calculate on its comparative definition and circum-

scription. I mentioned that these were the conditions which decided me in operating in Mrs. Jepson's case, although other surgeons had declined. Contrasting the history and vital manifestations of the tumour in her case with those of the cases operated on by John Bell, Warren, and Liston, in which complete removal had been found impossible, and in which the growth had returned, I pointed out that the histories of the latter cases showed evidences of malignant character, which, in my opinion, rendered operation improper in the present state of our knowledge; but that, so far from deterring from operative interference in favourable cases, they rather gave encouragement, by showing how much could be done even under unfavourable conditions.

Unfortunately, the proportion of malignant cervical growths is much greater than of those suitable for interference. Out of a very large number of such tumours which I have seen, especially since the successful operation on Mrs. Jepson—with the single exception of the present case—I have met with none in which operation would have been warrantable (I do not include ordinary parotid tumour), as they were all marked by the characteristics of malignancy.

When the tumour has been of rapid growth from the first, is of irregular consistence, and presents the general features of malignant disease, I believe that the propriety of operative interference is very doubtful, as the chances of complete removal and ultimate successful issue are very small. Even though there be considerable mobility and apparent definition, such growths very generally arise from or involve at an early period the transverse processes of the vertebræ, whilst their superficial margins feel loose and defined. Mobility of the tumour, though an important consideration in deciding on the question of operation, is only of real value when taken in conjunction with the nature of the growth. A malignant tumour may not only adhere to, but involve, the great vessels and nerves, and yet be very movable, for these structures, being loosely connected in front of the vertebræ, move readily along with the morbid mass. In my

remarks on Mrs. Jepson's case, I entered so fully on the special circumstances to be considered in deciding on the propriety of operating, that I would merely refer to it for information on these points, and limit my further observations on the present case to peculiarities in regard to its anatomical relations.

In the lad Manson, though the tumour was a very large one, it was entirely confined to the region of the neck, and hence did not give rise to the same amount of deformity as in Mrs. Jepson, in whom the growth occupied the parotid as well as the cervical region. In Manson, however, the tumour passed lower down into the subclavian and sternal regions, and, from being placed on the left side, lay in a position to press upon the thoracic duct and left recurrent nerve ; whilst the textures covering it in the sternal fossa rendered it impossible to ascertain positively its definition or attachments there. The perfect nutrition of the patient, however, showed that, though in close relation with the thoracic duct, it could not have involved that structure ; and though the spasmodic difficulty of breathing at night, which he occasionally felt, might be due to pressure on the left recurrent laryngeal, the symptom was only of recent occurrence and not constant, and hence was more likely to arise from pressure owing to the proximity of the tumour, than from the nerve being involved in or adherent to it. These considerations, taken in connection with the simple nature of the growth, and its origin high up in the neck, seemed to warrant the conclusion that its substernal portion was free, and merely bound down by the fascia and muscles.

During the operation some peculiarities showed themselves, which I think worthy of notice as exemplifying the difficulties we must be prepared for, and the care required in such operations, or rather dissections, of the neck. When the anterior margins of the tumour had been freed, and its deep surface dissected and raised off from the position of the carotid sheath, the whole length of the cervical portion of the carotid artery and vagus nerve was seen bare as if dissected, but there was no appearance of the internal jugular vein. This made me proceed

very cautiously, for two reasons : *first*, the great vein might be partly involved or displaced by the tumour, and thus liable to be wounded at some unexpected part ; and *secondly*, by the absence of the vein the sympathetic nerve and thoracic duct were left uncovered, and these important structures, undistinguishable amongst the tissues discoloured by blood, were exposed to great risk of injury. The phrenic nerve, from its white colour and comparatively superficial position, was easily enough seen and guarded. Indeed, the absence of the vein from its natural position, and the uncertainty as to whether it might be displaced, I consider the most embarrassing condition in the operation.

In describing the operation, I have stated that on dissecting the flaps from the surface of the upper part of the tumour I tied a large vein, which I was inclined to think was the displaced internal jugular vein ; and my reason for supposing this, was, that the vessel could be traced from the angle of the jaw passing downwards over and partly in a groove on the surface of the tumour in relation with the deep surface of the sterno-mastoid, and very much in the line of the jugular ; but as it was obliterated about the middle of the neck its continuity could not be traced lower down. The pervious portion was about the bulk of the forefinger, and full of blood for about two inches, when it became a flattened cord. I should presume, from the relations of the tumour, that it had probably originated at an earlier age even than that stated, viz. the third year, when it was first noticed by the patient's friends, and that it had developed itself from above downwards, and thus insinuated itself between the parts which usually occupy the common sheath, raising the vein on its surface and pressing the artery and vagus inwards, before its bulk overlapped them. I draw attention to this point, because it is well to be prepared for similar difficulties ; and I believe that the history of the case may guide us, as these anatomical relations seem to me to depend specially on the original position and development of the growth in early life, before the cellular texture of the common sheath has become condensed, and are not likely to be met with in cases where the tumour

commences at a later period of life ; for, as a rule, a simple tumour, whilst it may adhere to, or compress, or push aside structures, has no tendency to destroy texture or separate parts contained in a common fibro-cellular sheath.

In conclusion, I may state that neither in Manson nor Mrs. Jepson was the division of the sterno-mastoid attended by any malposition, or even by any interference with the movements of the head ; nor was the section of the cervical portion of the spinal accessory nerve followed by any appreciable bad effect. Both these patients remain perfectly free from any return of the tumour.

THYROID TUMOURS.

HYDROCELE OF THE THYROID GLAND. LARYNGO-TRACHEOTOMY.

F. O.—This patient first came under Mr. Spence's care in January last, on account of a tumour of the thyroid gland, which speedily yielded to blistering and the internal use of iodide of potassium. On July the 3d, he again presented himself, and was then suffering from considerable embarrassment of respiration, with occasional paroxysms of dyspnoea. Speaking, even for a short time, brought on violent fits of coughing, unaccompanied by expectoration. On examination, a tumour was found occupying the position of the isthmus and left lateral lobe of the thyroid gland, pushing the trachea backwards and to the right side, and extending downwards apparently behind the sternum and left clavicle, as was indicated by dullness on percussion and absence of respiratory murmur over the upper sternal and inner part of the clavicular and subclavicular regions. The chest was otherwise normal ; the superficial veins of the neck were much enlarged ; the left pupil was distinctly contracted. The treatment again pursued was blistering and the administration of the iodide of potassium, but on this occasion without any good effect, as the fits of dyspnoea became more frequent and more severe. On the morning of the 11th, a violent paroxysm suddenly coming on, I was hastily summoned, and, finding the patient's countenance turgid and livid, his respiration stopped, and his pulse scarcely perceptible, and believing that the immediate cause of his impending death was spasm of the glottis, at once determined to perform laryngo-tracheotomy. From the position of the larynx and trachea, the necessary incision, having to be made considerably to the right of the mesial line, laid bare the anterior margin of the sterno-mastoid muscle, and involved several enlarged veins. After the operation was finished, it was found necessary to inflate the lungs through the tube and keep up artificial respiration. The patient now rallied in some degree, but it was evident there was some obstruction below the opening made into the trachea. Accordingly the tube was withdrawn and the trachea

explored by the finger, when a convexity of the left side was discovered, so considerable as materially to diminish its calibre. A piece of gum-elastic tubing of large bore was now passed down beyond the obstruction, and its introduction was followed by instant relief to the patient. Next day, Mr. Spence examined the tumour by passing his finger through the wound, and, detecting fluctuation, made an opening at that point, when a large quantity of clear fluid was evacuated. He next made a counter-opening by cutting down on the point of his finger, passed downwards and to the right side, through the opening made from the tracheotomy wound. The finger was now passed through the second opening downwards, behind the left sterno-clavicular articulation, but failed to reach the bottom of the cyst. After the evacuation of the fluid, the patient could breathe quite freely through an ordinary tracheotomy tube, which had been substituted for the gum-elastic one. On the following day, symptoms of acute pyæmia set in, and the patient died on the evening of the 15th. On post-mortem examination, numerous metastatic abscesses were found in the lungs and liver.

E. F., æt. 27.—*HÆMATOCELE OF THE THYROID GLAND*, of five years' standing. This tumour, which was tense and elastic as if containing fluid, although of very considerable size, caused no inconvenience to the patient, who applied for surgical interference merely to be rid of the deformity. On puncture by a trocar and canula, a quantity of bloody serum was evacuated; but as little subsidence of the swelling followed, a free incision was made into the cyst, which was found filled with clots of blood. These were turned out by the finger, and the cavity stuffed with lint. Suppuration and granulation of the cavity followed, and some thickening which remained yielded to blistering and painting with iodine.

A. J., æt. 11 years, came to the hospital on the 10th of June, with a tense elastic tumour occupying the supra-sternal hollow at the root of the neck, and extending upwards to the isthmus of the thyroid gland. This, first noticed about two months before, when it was of small size and caused little uneasiness, had increased considerably of late, and was now materially interfering with respiration, from its pressure on the trachea. The voice was considerably affected, the respiration was stridulous, and at intervals there occurred paroxysms of dyspnœa, threatening suffocation. After two days' observation, as the patient's symptoms became more severe, Mr. Spence made a longitudinal incision through the integuments in the middle line of the neck, and carefully dissected down to the tumour, which proved to be an abscess in the midst of the thyroid gland tissue, extending downwards and backwards behind the manubrium. Evacuation of the matter gave immediate relief to the patient, who left the hospital well a few days after.

TRACHEOTOMY FOR REMOVAL OF FOREIGN BODIES.

CASE I.—On the morning of Thursday the 23d of September 1841, I was sent for in great haste to see a child, who, according to the statement of the messenger, "was suffocating from something sticking in the throat."

On reaching the house, which was situated in the immediate vicinity, I found the patient, a boy about the age of four years at most, asphyxiating ; his face was much swollen and livid, the eyes were protruding, and the veins of the neck turgid, with the nostrils dilated. The respirations were prolonged, and accompanied with a peculiar stridulous noise. The mother of the child told me, that, on the previous evening, having to go from home, she left the child in care of another woman, and that she had, before going away, given the child some small plums, while eating which he was observed to cough violently, and roll himself on the ground ; and on recovering from this state, he mentioned that he had swallowed one of the plum-stones ; but as no further symptoms occurred at that time, no notice was taken of it. He continued quite well, and slept as usual during the night, and took his breakfast the following morning ; but shortly before I saw him, and whilst playing about the room with the other children, he, on a sudden, cried out that he felt the stone in his throat, and almost instantly fell down in the state of suffocation which I have already described. Although I had no doubt whatever as to the foreign body being in the windpipe, yet, to make assurance doubly sure, I passed a probang down the œsophagus. This met with no obstacle in its passage, and, as I expected, afforded no relief. As the symptoms, therefore, were most urgent, the extremities becoming cold, and the pulse intermitting, I stated to Mr. Lawrie, surgeon, who was present, that I considered the operation of tracheotomy as the only chance of saving the child. Mr. Lawrie concurring in this opinion, I performed the operation, which was accomplished without greater difficulty or delay than what might be expected from the want of assistants and the struggling of the child. On the trachea being opened, a quantity of frothy mucus was forcibly ejected, but no foreign body. Through the opening, however, the child breathed freely, and the face soon resumed its natural appearance. After waiting a few moments, I passed a slightly bent probe upwards into the larynx, and downwards into the bronchi, but could not detect any foreign body. I therefore introduced a small trachea tube, and left the child in charge of my friend, Dr. Smith, until I could procure instruments for extraction. At 11 A.M. I again saw the child, along with Professor Syme, who kindly attended at my request. The child then breathed easily through the tube ; but when it was removed, and the opening closed, there was great difficulty in respiration.

The edges of the opening being held aside by small hooks, I again carefully examined both the larynx and bronchi with a probe, but most particularly the larynx, for all the symptoms tended to impress us with the belief that the foreign body was there. Mr. Syme also examined the parts, but could not detect it. It was agreed in consultation that it was best to enlarge the opening. I therefore divided the cricoid cartilage so as to allow a more ready examination of the larynx, and a more easy escape of the foreign body ; but we were still unsuccessful. Under these circumstances, we deemed it best to replace the tube until the following day. Nothing particular occurred during the remainder of the day ; the child was carefully attended to, he continued to breathe freely through the tube, and both sides of the chest seemed to expand equally, and at the same moment. He was ordered a little milk with warm water and sugar, for food, which he partook of readily, and slept at intervals. On Friday, Professor Syme

again saw him with me ; the tube was withdrawn, but the difficult respiration again returned when the opening was closed ; whilst, on the contrary, the breathing was free, and perfectly easy when it was left open. We again carefully examined the larynx and bronchi, but in vain. We could not detect any foreign body ; and we concluded that it had probably been pushed up by the probe, passed into the pharynx, and swallowed, and that the difficulty in breathing might be owing to swelling of the mucous membrane lining the larynx. The tube was once more replaced, and the same treatment adopted as before ; a gentle laxative was prescribed, and I desired the stools to be carefully examined. I again saw him at 3 P.M., when I found his breathing was hurried, together with a considerable degree of general fever ; the face was flushed, and the pulse rather quick and hard ; I therefore ordered some leeches to be applied over the region of the chest, the laxative medicine to be repeated, and an injection to be given in case it did not soon operate.

I again saw him at 8 P.M. ; he now seemed considerably easier, there was less fever and restlessness, and the breathing was less hurried ; the bowels had been freely opened, and the leeches had bled well. At 10 o'clock I was informed he was rather worse ; and, on visiting him, I found him very restless, his breathing had become hurried, and he was thirsty and hot. Having cleaned the tube, it relieved his breathing ; and I left him, and sent a person to remain with him during the night, with strict instructions to call me if he became worse. At half-past 11 o'clock I was again sent for, as the child had become suddenly much worse. I now found him fast sinking. I introduced a clean tube, and ordered him some wine and water, under which he rallied in a measure ; but it was only for a short period, as about midnight he expired.

Having obtained permission from the friends to examine the body, I did so on the morning of the 26th September, and the following were the appearances found on dissection :—

Post-mortem Examination of the Body.—I carefully examined the larynx and trachea, but could find no foreign body. There was a slight degree of vascularity of the mucous membrane of the larynx, together with some thick mucus in its cavity, but there was very little swelling of the parts.

I laid open the right bronchial tube, which presented nearly its natural appearance, with but slight degree of vascularity of its mucous coating, but there was no foreign body in it. The right lung, with the exception of a little congestion at its posterior part, was of a healthy appearance, and cre-pitated naturally on being pressed between the fingers. The left bronchus was next examined ; and as I saw no foreign body, I was about to give up all further investigation of the thoracic viscera, concluding that it had been pushed upwards during our examination of the larynx, as I previously conjectured, and that it passed into the stomach, when my attention was arrested by the peculiarly dark appearance of the lower portion of the upper lobe of the left lung ; and on cutting into this portion, I found the foreign body, a small damson-stone, impacted into one of the large subdivisions of the left bronchus, the larger end of the stone projecting upwards. No other parts were therefore examined.

Remarks.—In reflecting on the case which I have just detailed, some phenomena of a very unusual kind present themselves. In the first place, when we regard the history of the case given by the child's mother, the sudden manner of the attack, together with the urgent symptoms of asphyxia when first seen, and the almost immediate relief afforded by opening the trachea, although no foreign body was expelled; and if we add to this, that while the child breathed freely through the tube, both sides of the chest seemed to expand equally, and at the same moment; but that, on the other hand, whenever the tube was removed, and the opening in the trachea closed, difficult respiration ensued—I think few medical men would hesitate to pronounce as their opinion, that the foreign body was entangled in the larynx; and yet the case just narrated affords an example of all these symptoms being present, whilst the foreign body was impacted in one of the ramifications of the bronchus. It may indeed be urged, and I confess I cannot quite divest myself of the idea, that the foreign body was in the larynx when the child was first seen, and had thus given rise to the very urgent symptoms which led me to operate; and that, owing to the struggles of the child during the operation, it had been dislodged from the larynx, and passed into the bronchus. Still, allowing this supposition to be true, it leaves unexplained the cause of difficult respiration which constantly ensued on withdrawing the tube, and closing the opening in the trachea. This is perhaps the most peculiar feature of the case; and I can only attribute it to the irritation caused by the presence of the foreign body being conveyed along the nerves distributed on the mucous lining of the bronchus and trachea, towards the larynx, and so exciting spasmodic action of the muscles which close the glottis.

Last, but not least in point of practical interest, is the unusual situation of the foreign body in this case; for, so far as I am aware, there is no case recorded in which a large-sized foreign body has found its way into the left bronchus. Indeed, most writers on the subject speak of the foreign body passing down into the right bronchus, as if it were a constant rule.

As regards the extraction of a foreign body, if discovered under similar circumstances, I should think it, to say the least, exceedingly difficult; for in a child at that age, the trachea and bronchi are so small, as to afford but little room for the use of forceps or other extracting instruments. I believe that the only chance in this case of extracting the foreign body would have been (had its situation been discovered) to have loosened the foreign body from its position in the orifice of the bronchial ramification, by means of the flat end of a long probe, so as to allow the air to pass into the portion of lung beyond it, when it would probably have been expelled during expiration. For, of course, whilst it remained impacted in the bronchial ramification, it must have caused complete occlusion of that portion of lung to which that division of the left bronchus was distributed.

CASE II.—A fine little girl, four years of age, the daughter of a medical man in the country, was eating damson-jam, when one of the stones, which she had been sucking, suddenly slipped into the larynx. A violent paroxysm of cough and dyspnœa, threatening suffocation, immediately ensued; but the foreign body passing downwards, temporary relief was obtained. As similar paroxysms recurred, the father telegraphed to town for Professor Goodsir and myself to come out immediately.

When we arrived, we found that she had had some severe paroxysms, and that the means used by her father, and Dr. Baird of Linlithgow, who had also seen her, had failed to cause ejection of the foreign body.

Under these circumstances, and as the movement of the body in the trachea during respiration could be distinctly heard, we at once proposed tracheotomy, which indeed was the object of our being sent for, and therefore there was no delay.

The use of chloroform was tried at the request of the friends; but it excited such a tendency to suffocation that it was given up, and I proceeded to operate at once. Owing to the bulk of the thymus gland, the numerous dilated veins, and the presence of the middle thyroid artery, the operation required some care, but the parts were so distinctly seen that it was not prolonged.

I made a long incision in the trachea, and inserted the points of my dissecting forceps at the upper part, expanding their blades to keep the orifice patent; on doing this, and raising the head, a quantity of mucus was ejected; then the plum-stone was seen to be forced towards the opening. But, unfortunately, at this moment inspiration took place, and the rush of entering air carried it back.

We attempted to cause its expulsion by inducing coughing, and by shaking, and altering the position of the little patient, but in vain. On examining the chest, it at once became evident that the stone had become

impacted ; for while the right side expanded on inspiration, the left was flattened and immovable, the lower ribs being drawn forcibly inwards, and the respiratory murmur entirely absent.

By means of flattened probes passed along the left bronchus, we attempted to reach the stone for the purpose of dislodging it ; and we tried to procure its expulsion by moving the thoracic parietes, and by every means we could think of, but without success.

In consultation it was determined to take the child to town with us next morning, and try if any plan could be devised to loosen it by instruments or by suction.

Having brought the patient to Edinburgh, a great variety of means were tried, but with no better result ; and, after a few days' illness, the child died.

On examination after death, the damson-stone was found impacted in the left bronchus, fairly filling it up like a cork, and preventing all entrance of air into the left lung, which was flaccid and collapsed ; the thoracic parietes of the left side, as seen during life, were contracted and flattened. The child, at the time of the accident, was just convalescing from a severe attack of pneumonia of the right lung, the lower part of which had suffered so as to be hepatised, while the upper part was engorged with bloody serum, and the bronchi loaded with mucus ; so that the child died more rapidly than would have been the case had the right lung been healthy.

Remarks.—The foregoing case presents several points of interest. 1st, The direction in which the foreign body was carried ; 2d, Its impaction at the termination of the left bronchus, and the complete occlusion of the tube and collapse of the lung thereby occasioned ; and 3d, The question as to what means can be suggested for the treatment of similar cases.

In regard to the first of these points, it is very generally stated that foreign bodies entering the air-passages pass into the right bronchus ; this and the preceding case, however, show that there is nothing to prevent a foreign body passing down the left bronchus.

As to the second, in the case just narrated the plum-stone was much larger than in the former case, and was so placed as completely to prevent any air from entering the left lung, and hence to preclude any chance of its being forced out by an effort at expiration ; the marked flattening and other symptoms leaving no doubt as to its position, or as to the collapse of the corresponding lung.

Third, as to the treatment. I have always regretted that chloroform should have been given in this case, for I think that the condition it induced rendered the expulsive efforts less forcible than they usually are in such cases. The appearance of the foreign body was so momentary that there was no time to seize it, even if we had not expected that it would be forcibly expelled. The manner in which it was carried back into the bronchus, and the evidently complete occlusion of air from the left lung, rendered all chance of its expulsion hopeless; and therefore no time was lost in trying, by the means already mentioned, to loosen it from its position, so much at least as to admit air along its side into the lung beyond, and so favour its expulsion. This was principally attempted by the use of flattened probes; but we felt, at the same time, the risk of impacting the stone more firmly, and therefore great care was taken to keep the flattened probe close to the sides of the tube in passing it. As I have said, neither this nor inverting and shaking the patient, produced any effect. In the subsequent attempts, the application of some suction power, applied through a tube passed down the bronchus, was suggested; but, in consultation, it was agreed that the irritation to the passages by these manipulations would be productive of more harm and risk than its chance of success could compensate for, and that by leaving the child quiet for a time, the body might become loosened by the changes induced by its own presence. Unfortunately, however, the state of the right lung precluded the chance of the success of this plan, which, under ordinary circumstances, I believe, would be the wisest to adopt.

As to other methods, in my remarks on Case I., I have stated my opinion that, even if we were sure of the position of the foreign body, the small size of the passages renders the introduction of extracting instruments impossible, and that, unaided by the natural expulsive efforts, artificial means would be very inefficient; and I regret that my experience in this second case does not enable me to alter my opinion.

CASE III.—Madeleine H. was admitted into the Royal Infirmary on the 29th of June 1857.

About three hours before admission, while she was playing with a plum-stone and a cherry-stone in her mouth, they both suddenly slipped down her throat; this was followed by a convulsive fit of coughing, and she was found by her mother lying on the ground in a paroxysm of dyspnœa; the plum-stone was lying beside her, but the cherry-stone could not be found. I saw her at her house; but, as the urgent symptoms had disappeared, and there seemed some doubt as to the history of the case, I sent her to the Infirmary to be carefully watched.

On admission she had an occasional slight laryngeal cough, pain on pressure over the larynx, and an apparently altered tone of voice, but no difficulty or noise in breathing, and no sign of the presence of a foreign body could be detected by the stethoscope.

During the night she was constantly watched, in case of asphyxia occurring suddenly. She slept quietly during most of the night, but towards morning had several very alarming attacks of dyspnœa, so much so, that tracheotomy was twice about to be performed.

Next day she was much in the same condition; and, after consultation, tracheotomy was decided upon, and forthwith performed. After the first incision a severe fit of coughing came on, and the dyspnœa was so great that the operation was rapidly concluded on account of threatened asphyxia. As soon as the windpipe was opened, and the edges of the incision separated, the foreign body was forcibly ejected by a violent expiration, and the breathing immediately became perfectly calm. A tube was introduced, but removed after three hours, the breathing being quite easy and chiefly by the natural air-passages after its removal.

On the following day the edges of the wound were approximated by a strip of plaster; the breathing was calm, and almost entirely through the larynx.

The wound gradually closed, the patient's convalescence was uninterrupted, and she was dismissed cured a week after admission.

Remarks.—This case is instructive as exemplifying the uncertainty which sometimes exists as to the presence of the foreign body.

The accident frequently occurs when the child is playing; the child is suddenly attacked by a convulsive cough and threatened suffocation. On recovery from this paroxysm it says it has swallowed a plum or cherry stone; but, as the symptoms pass off, and the breathing and speech become natural, the friends think that the foreign body has either been swallowed or coughed up, and that the danger is past; and medical aid is deemed unnecessary till another paroxysm of threatened asphyxia suddenly occurs. Such was the history in the case last narrated;

but this case was even more complicated, because the convulsive cough had expelled the plum-stone, and there was therefore a probability of the smaller body having also been expelled.

When I saw the patient, her breathing was easy, both sides of the chest expanded naturally, her voice was quite natural, and she spoke freely. The only positive symptom was a somewhat croupy sound when she coughed ; but her mother stated that any cold or irritation always produced that symptom in her ever since she had had hooping-cough, two years before.

On examination with the stethoscope over the trachea and chest, neither my friend Dr. Dunsmure nor myself could detect any sound indicative of a foreign body moving in the air-passages. I thought, indeed, that there was a peculiar sound a little below the right sterno-clavicular articulation ; but nothing decided, or at all like what I have heard in other cases of foreign bodies in the trachea. But, in opposition to the view that the stone had been expelled, the girl stated that she felt the cherry-stone go down when the plum-stone was expelled, and that she still felt it at times in her throat (pointing to the trachea). The cherry-stone could not be found anywhere near where she had been playing ; and Mr. Adams, a young medical man, who first saw her, distinctly stated that the symptoms were those of a foreign body having passed into the trachea.

Under these circumstances, having everything prepared for tracheotomy, we determined to ascertain the presence of the foreign body by inverting the patient and shaking her, so as to throw the stone (if in the air-passages at all) towards the larynx, and render the symptoms of its presence unequivocal.

This was a somewhat hazardous experiment, but safer than leaving the question in doubt.

As even this manœuvre produced no cough or paroxysm, our doubts as to the presence of the stone in the trachea or bronchi became greater. I therefore recommended that she should be taken to my wards in the Infirmary, where she would be carefully watched, and where surgical aid could be had at once, if necessary.

I saw her twice during the evening while she was asleep, and her breathing was then quite calm and natural. The occurrence of the paroxysms of suffocative cough during the night left little doubt as to the propriety of tracheotomy, and the operation was at once decided upon in the consultation, although at that time she was again quite free from any urgent symptom.

In cases like this, where there is considerable doubt as to the presence of the foreign body, it may be deemed advisable to wait, if the patient be placed in such circumstances that tracheotomy could be immediately performed should symptoms of suffocation supervene ; but I confess that my experience in this case would lead me, notwithstanding the negative evidence afforded by auscultation, to urge the performance of the operation, so as to place the patient beyond the risk of a sudden fatal paroxysm, such as happened in the case alluded to in the Society by Dr. W. T. Gairdner, where a child, in very similar circumstances, died in the hospital before the house-surgeon could reach the ward.

Doubtless there are cases on record where foreign bodies have passed into the bronchi, and have after a time been ejected by coughing ; and sometimes this has occurred even after tracheotomy had been performed without success. But such rare exceptional cases can never form a rule for practice ; and, to say nothing of the immediate risk of asphyxia, the continued irritation induced by the presence of even a small foreign body is almost certain to induce disease in the lungs, and ultimately to destroy life. In a female, said to have died from phthisis, with constant cough, I found thickening of the tracheal mucous membrane, and, on opening the larynx, discovered in one of the ventricles the pip of an orange, partly confined in its position by bands of lymph. The history of the case, so far as it could be traced, left but little doubt that the irritation of the foreign body had been the origin of the pulmonary disease. But the propriety of operating early in such cases is now so generally admitted, that I need not insist on it.

In performing the operation in such cases, it is of great

importance to hold the incision in the trachea widely expanded, as the elasticity of the rings tends to close it, and so to impede the expulsion of the foreign body. In former cases, I have inserted the points of my dissecting forceps, and then expanded the blades; but in this case I adopted the simpler plan of inserting the thin ivory handle of the scalpel I was using, and then turning it flat at the upper part of the incision; it thus widely expanded the tracheal opening, occupied the least possible space, and effectually prevented any risk of a foreign body passing from the larynx into the bronchi; whilst it also gave distinct evidence that the cherry-stone must have been in the trachea, and not in the larynx, as the peculiar cough had led us to suspect.

PORTION OF TRACHEOTOMY TUBE IN BRONCHUS—EXTRACTION.

"G. F., aged 33, came to the hospital on June 4th, 1863, stating that, about half-an-hour before, the shield of a tracheotomy tube, which he had worn for the last twelve months, had suddenly become detached, and that the cylindrical portion had slipped down into his windpipe. He pointed to a spot corresponding to the bifurcation of the trachea, and said he felt the tube there. He spoke and breathed without difficulty; and the only signs of irritation were severe fits of coughing recurring at frequent intervals. Mr. Spence, having introduced a gun-shot probe into the trachea, guided it into the right bronchus, but failed to discover any foreign body. The left bronchus was next explored, and then the probe was distinctly felt and heard striking the metallic tube. Chloroform was now administered, and the opening into the trachea having been enlarged, a forceps, with blades bent almost at a right angle, was guided downwards into the bronchus, and passed *within* the tube with the blades closed. The blades of the forceps were next *forcibly expanded*, and the tube thus caught was readily extracted, with immediate relief to the patient, who left the hospital quite well four days after.

Remarks.—"All that need be remarked concerning the case of G. F. is, that the tube was readily extracted, owing to the happy way in which it was caught, and that in this, as in the majority of such cases occurring in the practice of Mr. Spence, the foreign body was found impacted in the *left bronchus*, and *not in the right*, in which, according to the statements in books, foreign bodies more frequently lodge."

In June 1862 I received from a former pupil, the late Dr.

Temple, a preparation of the larynx and trachea of a boy, who had died suffocated. A quantity of half-masticated food is impacted in the larynx and upper part of the trachea. No portion of the mass is above the level of the upper part of the thyroid cartilage, and therefore, as the accompanying history of the case shows, could not have been felt from the mouth.* The preparation is in my private museum.

The patient was a boy about 12 years of age. When first seen he seemed to be dying asphyxiated, and supposing it might be from spasm of the glottis, I had the patient immediately placed in a warm bath which was standing ready, and a jug of cold water poured upon his head. The shock partly restored consciousness, and on being asked if he were suffering pain, replied "Here" (in a very husky voice), pointing to his throat, then died instantly. The finger had been passed down the throat, but nothing could be found obstructing the gullet. The parents stated that he had had somewhat similar attacks before, and always spoke in a husky tone of voice. Whilst sitting at dinner, he was seized with what they considered one of the attacks to which he had been subject. Only a few seconds could have elapsed between his being seized and being seen, and nothing had been done to the boy before my arrival. On dissection, the carotid artery of the right side was found crossing the trachea immediately at the situation where the incision would have been made in performing tracheotomy, and could scarcely have escaped being wounded or cut across, whilst the trachea itself was surrounded by an immense aggregation of enlarged glands, thus perhaps accounting for the husky speech by the pressure they had exerted on the recurrent laryngeal nerves.

CASES OF TRACHEOTOMY IN CROUP.

CASE I.—John Blakeley, aged $4\frac{1}{2}$ years, was seized with hoarseness and pain in the throat on the 5th of April 1856. As he did not seem very seriously ill, he was allowed to play out of doors as usual; but on the 7th the symptoms increased so much in severity, and were so evidently those of croup, that his mother applied for medical aid at the dispensary. He was accordingly seen, on the evening of the 7th, by Dr. Glen, then one of my dispensary pupils, and was ordered a warm bath and some medicine.

Next morning, when Dr. Glen saw him, he desired the mother to ask me to visit the child.

On going to the house I found the patient in great agony from dyspnoea. As there was no great amount of bronchitis present, and evidently no time to be lost, I caused the child to be brought to the hospital, which was in the immediate neighbourhood, and at once performed tracheotomy. Some mucus and shreds of lymph were expelled on introducing the tube; the breathing then became easy, the lividity of the face passed away, and the little patient seemed quite relieved.

* This is the exceptional case referred to at p. 1015.

He continued to progress favourably, and on the evening of the third day the tube was removed, but had soon to be replaced on account of threatened asphyxia. It was finally removed on the sixth day, after which the wound gradually healed, and the child was dismissed cured on the 28th of May. He has continued to enjoy excellent health ever since, with the exception of showing a susceptibility to hoarseness during damp weather.

For the notes of the following case I am indebted to my friend Dr. Wilson, and I give the report in his own words:—

CASE II.—“C. W., aged $3\frac{1}{2}$, was first seen by me on the 19th of September, on the second or third day of an attack of scarlatina. From my first seeing him the case presented a very bad aspect; the throat was considerably affected, and then a troublesome diarrhœa set in, accompanied by typhoid symptoms, for which he had very large quantities of wine, gradually increasing to 10 or 12 ounces a day, chlorate of potash, astringents, etc., which were evidently beneficial; and I was in hopes he was going to struggle through, when, at the end of the third week of the disease, he was seized with symptoms of laryngitis.

“These increased, and the case seemed hopeless if left to itself; but the disease being apparently confined to the upper part of the larynx, the propriety of operative interference suggested itself to me, and I determined to ask you to see him. This you most kindly did, accompanied by Dr Watson, on the 10th of October.

“The child was much emaciated, and the pulse feeble; still, as the disease appeared to be confined to the upper part of the larynx, you resolved to give him the chance, though small, of the operation. Immediately after the operation the breathing became quite easy, and continued so till death, except on two occasions, when attempts were made to dispense with the tube, and the nurse was unable to introduce it on a paroxysm of dyspnœa ensuing, although the patient had been breathing easily during the time your assistant remained. He continued to take both wine and beef-tea in large quantities, and by injection; but the stomach began to fail, the pulse became feeble, emaciation progressed, and he died on October 15th, five days after the operation.

“On reviewing the operation at this distance of time, I have no hesitation in saying that the operation, though unsuccessful, was most beneficial, even allowing that it did not prolong life, which, however, I am inclined to think it did; still the relief afforded was so great, that I would be inclined (however reluctant we must be to advise operations not likely to be successful), were a precisely similar case occurring to me, to recommend the performance of tracheotomy.”

CASE III.—William Lindsay, aged four years, was seized with hoarse cough, sore throat, and occasional difficulty of breathing, on the 15th of October 1856. No treatment was resorted to till the 16th, when the symptoms became more severe, and Dr. Menzies was called to see him. He was then labouring under symptoms of croup; the stridulous breathing and paroxysms of dyspnœa occurring, however, at lengthened intervals. His

pulse was very rapid and small. Leeches were applied over the neck, followed by a blister, and antimonial solution was ordered to be given at stated intervals.

On Sunday the 17th Dr. M. found the little patient so much worse that he requested me to see him, in case I might think it advisable to perform tracheotomy.

I found him suffering from very urgent dyspnoea, with prolonged stridulous inspiration and very short expiration. The expansion of the thorax was deficient, the ribs being drawn inwards during respiration. The pulse was small, and the face livid. There was some slight bronchitis, but not to such an extent as to forbid the operation, which was accordingly performed, and a double tube introduced. A quantity of mucus was expelled on opening the trachea, and then the breathing became easy. A piece of muslin was placed over the orifice of the tube, and the attendants were shown how to clear it from time to time.

In the afternoon, when I saw him, I found him much relieved. The colour of the face was natural; the pulse, though still quick, was softer, fuller, and less rapid than in the morning; the breathing was quite easy.

I removed the inner tube, cleaned it, oiled it slightly, showed the attendant how to remove and clean it, and made her take it out and replace it, to make sure that she understood me.

Next morning I found him still improving, and breathing so easily, that, after cleaning the tube, I did not think it necessary to visit him again that day.

On Tuesday the 19th, when I called on Dr. Menzies to accompany me to see the patient, I learned, to my great surprise, that he had died at 3 A.M. Dr. M. informed me that he had seen him after my visit, and found him still doing well, and breathing quite easily. About 1 P.M., however, owing to some mucus obstructing the tube, a fit of dyspnoea came on. The nurse, instead of withdrawing the inner tube, although she had been taught how to do it, became alarmed, and it was only when the child was nearly suffocated that his father, in desperation, took it out. This at once relieved the breathing; but the effects of long-obstructed respiration soon showed themselves in pain in the head, dilated pupils, and other symptoms of cerebral effusion. The poor child soon became comatose, and died thirty-nine hours after the operation.

CASE IV.—George Stark, aged 5 years, admitted to the Infirmary on the 19th of March 1857.

The patient has been subject to cough for the last two years, and is liable to occasional acute aggravations of it. He was seized with one of these attacks about a fortnight ago, and was considerably worse than usual. His symptoms became gradually more urgent, and he was brought to the hospital on the 18th of March, suffering from a severe attack of true croup. The usual treatment, including repeated counter-irritation, was used in vain, and on the 19th he was so ill that tracheotomy seemed to afford the only chance for life. The breathing was noisy and laborious, the respirations being 30 per minute; the expansion of the chest in inspiration was very imperfect, and there was marked depression of the lower ribs in expiration. The operation was accordingly performed, in the usual way,

and a double tube introduced. Great relief to the breathing immediately followed the operation.

20th.—Pulse 140 ; skin hot ; but patient breathing much more easily. The tube is carefully kept clear. Since the operation, considerable pain and tenderness have been felt below the left jaw.

22d.—Pulse 120, and skin cooler. The tenderness below the jaw has disappeared. Breathing very easy. The tube was taken out to-day, and did not require to be replaced.

25th.—Pulse 120, rather small ; ordered ʒij wine. The tube required to be replaced, as the breathing was becoming impeded from the closing of the wound.

26th.—Tube finally removed to-day ; doing well.

30th.—Pulse 100 ; breathing easy ; general health very much improved.

April 6th.—Pulse 100, full and soft ; general appearance much improved ; and the tracheotomy wound is closing rapidly. The raw surface left after the repeated blistering is still sloughy and irritable.

10th.—Going on very well ; wound nearly closed, and blistered surface healing.

20th.—Continues to improve.

29th.—Dismissed cured.

CASE V.—Margaret Kerr, $2\frac{1}{2}$ years of age ; was admitted into the Royal Infirmary on the 5th September 1857.

The patient was seized with symptoms of croup on the evening of September 2d, but was not alarmingly ill until the afternoon of the 4th, when medical advice was obtained.

In spite of the treatment adopted—warm bath, leeching, and blistering—the little patient got rapidly worse, and was brought to the Infirmary by Dr. Gordon in an extremely exhausted and almost moribund condition, at mid-day of the 5th instant.

Tracheotomy was performed by Mr. Spence without delay. There was no trouble from hæmorrhage ; some shreds of lymph and a small quantity of mucus tinged with blood escaped at the moment of opening the trachea. A double tube was introduced, and secured behind the neck in the usual way.

The operation was followed by immediate relief to the breathing ; but the extreme prostration, the lividity of the countenance, and the smallness of the pulse, passed off but slowly.

She was immediately put to bed in a warm room, hot bottles placed around her, and wine freely given. Under the use of these means, she gradually revived ; the face regained its natural colour, and the pulse became stronger.

For the first few hours after the operation she was constantly watched by a dresser, the tube kept clear with a feather, and the inner tube frequently removed to be more effectually cleaned. The nurse, and the mother of the child were also taught how to do this.

Sept. 6th.—The tube has been constantly kept clear, and the breathing has been quiet and easy during the night, except from slight occasional attacks of dyspnoea from the imperfect expectoration through the tube.

To-day the pulse is good, skin moist, and colour natural. The wine, which has been given in small quantities during the night, is to be discontinued.

7th.—Progressing very favourably ; pulse full and rapid ; skin dry. Bowels opened to-day spontaneously. Ordered small doses of ipecacuan wine to be frequently repeated ; also a sinapism between the shoulders.

8th.—Going on very well. The tube was removed to-day ; but it was necessary soon to replace it, as great dyspnœa followed any obstruction of the tracheal wound.

9th.—Tube removed to-day, and not replaced. She is breathing almost entirely by the natural air-passages.

12th.—Progressing very favourably ; wound closing.

16th.—Report as at last entry.

26th.—Just recovering from a smart attack of dysenteric diarrhœa ; wound almost healed ; breathing calm and natural.

Remarks.—All these cases of croup present some symptoms in common—viz. dyspnœa, lividity of the countenance, deficient expansion and drawing in of the thoracic parietes during respiration, and marked stridulous breathing ; together with paroxysmal exacerbations of the dyspnœa, gradually increasing in frequency and intensity. In none of them was there any great amount of bronchial affection ; and, with the exception of the boy Blakeley and the girl Kerr, where some small shreds of lymph were expelled after opening the trachea, in none of them did the crupous exudation seem to have taken place to any great extent on the tracheal mucous surface, although the tenderness over the trachea prior to the operation, and the appearance of the lining membrane, as seen on opening the tube, proved that it was to some extent implicated. In these cases, therefore, the diseased condition may, for all practical purposes, be considered as confined to the larynx at the time when the urgent symptoms arose ; and hence they all were in that respect favourable for giving the patients the benefit of the operation. In all, however, there was unmistakeable evidence of bronchitis and bronchial effusion occurring subsequently from extension of the inflammation, most probably increased by the operation and necessary presence of the tube. Indeed, from what I have seen of cases of tracheotomy, even for the removal of foreign bodies, where of course no bronchitis existed prior to the operation, I

have little hesitation in saying that bronchitis or bronchopneumonia almost invariably occurs after it. I draw attention to this because bronchial effusion forms a most serious complication in very young children after tracheotomy, and is indeed one of the great objections to the operation in cases of croup. When present to any extent it has generally been held, in this country at least, to contra-indicate tracheotomy, and, I think, with good reason. In children under three or four years of age, from the small size of the tube we can introduce, it is apt to become choked with the tenacious mucus, as happened in one of the cases narrated ; and as, of course, we cannot make the infant understand how to cause forcible expulsion of the mucus from time to time, by placing the fingers so as to diminish the orifice of the tube, or of the wound, as we can in older children or adults, such a case is entirely dependent on the care and experience of the attendant or nurse in the after-treatment ; and the danger of extensive bronchitis in a child of that age, even apart from other complications, is too well known to need to be insisted on. In no operation, perhaps, do the chances of success depend more on the care and watching of the patient by experienced attendants than in tracheotomy. In looking back on the cases detailed, I cannot but think that, had the patient Lindsay been in the hospital, the result would probably have been as successful as the cases of Blakeley and Stark ; certainly his state at the time of the operation was fully as favourable, and, when I last saw him alive, he was progressing well. Indeed, the history of his case shows pretty clearly, that the paroxysm of dyspnœa, owing to the obstructed tube, led to fatal cerebral congestion and effusion. In all cases, it is obviously desirable to remove the tube early ; but the foregoing cases, as well as other cases of tracheotomy, have shown me that you can never venture to do so without being prepared to replace it at any moment on account of some paroxysm of obstructed respiration ; and this implies the necessity of having proper assistance at hand, a condition not easily attained in private practice.

The presence of any extensive exudation of false membrane

must always be a formidable objection to tracheotomy. If partially loose, it may be so placed as to act as a valvular obstruction at the lower aperture of the tracheotomy-tube; and if the membrane exist in the complete tubular form, as in that state it is often but loosely attached, it may collapse, on the trachea being opened, and cause immediate suffocation. If I am correct in holding the opinion that bronchitis or crupous exudation, when present to any extent, form objections to tracheotomy, it must be evident that very few of the cases which we see in young children admit of its performance with reasonable chance of success, except at a much earlier period of the disease than is generally thought proper to consider of its propriety in this country. In estimating the success of the operation for croup in France by M. Trousseau and other surgeons, we must keep in mind, not merely the comparatively great success of what has proved by no means so successful an operation in this country; but, taking into account the early stage in which it has often been performed there, we must ask ourselves whether many of the cases might not have recovered under active treatment without such a hazardous operation. In very young children, under three years of age, besides other dangers incident to the operation at that period, the bronchitis, which follows the operation, must render the chance of success very small indeed, and the unfortunate results of such cases often prevent the surgeon being permitted to perform tracheotomy in cases proper for it. As to the question of the propriety of the operation in cases such as that of the child Walker, where the laryngitis supervenes during scarlatina, even though the operation, as in his case, may effect all the benefit we could expect in relieving the dyspnoea, the state of the patient in other respects hardly affords much hope of recovery, and we can only regard the operation as a palliative. Viewed merely in that light, however, I think few who have seen a patient struggling in agony for breath would not feel satisfied even with the temporary relief afforded by the operation in that case; besides this further consideration, that without it there was no chance for life being prolonged even a few hours.

The case of the child Margaret Kerr, it will be noticed, stands as it were in opposition to some of the opinions I have expressed as to the performance of tracheotomy for croup in very young children, and in the advanced stage of the disease; for this infant, only $2\frac{1}{2}$ years of age, was almost moribund when I operated. But whilst such a case, to a certain extent, may modify the remarks formerly made, and affords encouragement to attempt relief even in very unfavourable circumstances, and with the further warrant of its being the only chance for life, yet we must not be carried away, by the result of an exceptional case, to expect anything like general success in similar cases; and when we operate under such circumstances, the grounds on which we proceed should be clearly stated to the friends; and, from what I have said formerly, the surgeon must expect to meet with cases in which the child may die during the operation, or immediately on the trachea being opened.*

CASES OF CROUP—Second Series.

1. The patient, D. R——, $7\frac{1}{2}$ years of age, came home from school on the afternoon of the 21st January 1858, on account of a constant irritating cough, but he complained of no difficulty of breathing, nor any other urgent symptom, till about 8 P.M. on the 22d, when the dyspnœa rather suddenly supervened, and increased so rapidly, that a medical man was summoned, and found him so ill that he recommended me to be sent for to perform tracheotomy. When I saw him, about half-past 10, he appeared moribund, breathing only at long intervals, the chest not expanding, the pulse scarcely to be felt. Having explained the probability of the child dying during the operation in such circumstances, the parents still expressed their desire that the chance might be afforded him. I accordingly performed the operation, and on inserting the tube some mucus was ejected. By keeping up artificial respiration, administering enemata of port wine, and applying sinapisms to the abdomen, the respiration and circulation gradually became restored and regular, but the pupils remained dilated, insensible to light, and the child was quite unconscious. In about two hours after the operation, he became sensible, expressed relief, breathed easily, and had some sleep, and in the morning I was equally surprised and gratified to find him in a state which pro-

* These remarks on the foregoing cases of tracheotomy in croup were published in 1858, and I have reprinted them here to show what my original views were, and that my present opinions, and my advocacy of this operation, are the results of my previous views having been gradually modified by experience.

missed every hope of success. At noon I changed the tube, and replaced it by a double one, so as to ensure it being kept thoroughly clean. He had a dose of grey powder, and small doses of antimonial wine were ordered to be given at intervals. In the afternoon, however, the breathing again became difficult, although the tube was quite clean; and at 10 at night I found him tossing about, with great dyspnœa and rapid pulse. The tube was again withdrawn and examined, and found free from obstruction, and replaced by another, but without any relief. I bled him to the amount of 3 oz., with temporary relief to the urgent dyspnœa and violent action of the heart, but he soon relapsed into the same state, became insensible, and died about midnight.

On examining the body, the larynx and a considerable extent of the trachea were found to be lined by a tubular effusion of false membrane, the lower portion of which had passed farther down than the incision in the trachea, but had been pushed aside by the tube when introduced. Patches of lymph were found at the commencement of both bronchi, whilst the smaller subdivisions of the bronchial tubes were at many points quite blocked up by little masses of exudation. There was no great amount of mucous effusion in the bronchi, but the substance of both lungs was much congested. (See Plate 50, Fig. 2.)

2. Margaret B., æt. 7½, after playing on Leith Links on a cold wet day, was seized on the 26th of March with a severe, rough, and hard cough. On the 1st of April Dr. Williamson found her labouring under acute croup. Although the symptoms were very urgent, yet, on consultation, it was determined to delay operating till other remedies were tried. Next morning the symptoms were so intensely aggravated that I was sent for to operate. On my arrival the dyspnœa was great, pulse weak and intermittent, and the surface cold. Stethoscopic examination showed the presence of mucous râles in both lungs, and this, with the exhausted state of the child, induced me to consider it an unfavourable case for tracheotomy. The operation was performed, however, partly to relieve impending suffocation, and partly at the earnest desire of the parents. On opening the trachea, some mucus was ejected, and the relief to the dyspnœa was immediate. From this time the child progressed most favourably, the mucus being readily expectorated through the tube, which was retained for upwards of six days.

3. Louisa Paton, æt. 5, was attacked with croup on the evening of the 15th April 1858. The medical attendant, who saw her on the 16th, administered the usual remedies without effect; and as the disease was progressing rapidly, she was removed to the Infirmary on the 18th, and the same evening tracheotomy was performed by Mr. Spence. The immediate relief was great. She continued better all next day, but again became worse, and died on the morning of the 21st, about fifty-one hours after the operation, and the sixth day of the disease.

4. Marion Henderson, æt. 4, had a regular attack of measles in the last week of July 1858. On the 29th there was considerable cough and dyspnœa, the latter of which was much more urgent on the 31st, and next day was so great as to necessitate tracheotomy. There was much relief at the time, but she soon relapsed, and died on the morning of the 2d August.

5. George Nash, æt. 2, caught cold on July 4th, 1858. Next day

symptoms of croup supervened, and on the 7th a suffocative spasm necessitated his removal to the Infirmary. Emetics and sinapisms proving useless, and the paroxysms having recurred several times, Mr. Spence that same evening opened the trachea. The child continued restless till 4 A.M., after which he slept for nearly two hours. Next day the breathing was somewhat more laboured, but after the application of a sinapism between the shoulders it became easy and the pulse natural. On the 11th the tube was removed for a short time, but required to be replaced owing to the large amount of tough mucus clogging up the trachea, and which could only be expelled through the tube. Two days after, the tube was finally removed; and on the 4th of August he was dismissed, the wound in the trachea having been healed for some time previously.

6. F. S., æt. 6, was first visited by Dr. James A. Sidey on the 5th of November. He had been suffering for five days from feverishness and sore throat, and on the previous evening had shown symptoms of croup. When seen his tongue was foul, tonsils ulcerated, breathing difficult and croupy, and pulse 140. Leeches and emetics failed to give relief; and next day, his breathing having become more gaspy, I was sent for, and performed tracheotomy. I extracted some false membrane during the operation, and after it the child coughed up some moulds of the bronchi. He continued well during the whole of the next day, but on the 8th began to get worse, and died November 9th, 1858.

About a week or ten days after, his two sisters were affected with undeniable scarlet fever, and his mother with ulcerated sore throat.

7. W. R., æt. $4\frac{1}{2}$ years, after sitting out in the garden, towards evening, on the damp grass, began to suffer from a severe cold. Five days after, on the 29th of March 1859, Dr. Wm. Ziegler was sent for. There were signs of slight bronchitis in both lungs; the cough was hard, ringing, and croupy; the inspirations were free from stridor; he was dull and listless, and had lost considerably in flesh, but there was no febrile excitement, nor pain on pressure over the larynx. He was ordered an ipecacuan emetic, to inhale steam, fomentations over the larynx, and a sinapism to the chest. On the 30th the cough was not so hard, but the bronchitic râles were more general over the posterior lobes of the lungs; there was slight mucous expectoration; the skin was hotter and the pulse quickened. A blister was applied to his back, and he was ordered a mixture containing antimonial wine; the ipecacuan emetic to be repeated if the breathing became oppressed.

On the 31st he was rather worse, his breathing having been much oppressed during the night. He was restless, his pulse rapid and weak, skin hot, face flushed, cough more frequent and decidedly croupy, inspiration husky and laryngeal. There was, however, no lividity. The ipecacuan having failed to induce vomiting, sulphate of copper was given instead. Small quantities of white wine whey were administered, and the inhalations and fomentations continued. During the day the sulphate of copper was given several times, and each time induced severe vomiting, but without producing any favourable change. Mr. Spence was therefore called in consultation; and on April 1st, at 4 A.M., it was found necessary to perform tracheotomy. Considerable relief followed the operation, and

the child's progress to recovery was rapid. The tube was removed on the fifth day, and it was not again found necessary to return it.

8. — O —, æt. 4½ years. After the child had suffered from croup for twenty-four hours, during which time all the ordinary remedies had been unsuccessfully employed, Mr. Spence performed tracheotomy. This was followed by immediate relief, even although the chest did not expand very fully. The child went on improving for the next twenty-four hours, when, on the return of the dyspnœa, the tube was removed and a larger one introduced. This was again followed by great improvement, continuing for the next five hours. He then became restless; a considerable difficulty of inspiration commenced; expiration remaining so free that he blew out a lighted taper placed before the mouth of the tube. This attack lasted about half-an-hour, when he died.

Examination, thirty-six hours after death, showed great emphysema of both lungs, some congestion, but no pneumonia. The croupous membrane was confined to the larynx, but the trachea and bronchi were lined and partially blocked up with very tenacious mucus. The right side of the heart distended with dark blood.

TRACHEOTOMY IN DIPHTHERITIC CROUP.

1. Ann A., æt. 2½, admitted December 4, suffering from diphtheria with severe laryngeal symptoms. She had been ailing about a week, but the dyspnœa only became urgent the day previous to admission. As the paroxysms were frequent, and the breathing greatly impeded, the trachea was opened. Immediately after the operation, the patient fell into a quiet sleep. She went on most favourably; the tube was removed on the fifth day, and she breathed freely through the wound. On the eighth day the wound became dry and grey; on the tenth a slough separated. The constitutional symptoms accompanying this attack of sloughing phagedæna were of a very low type. She died on the eleventh day. The local treatment consisted of the application of strong nitric acid, with chloride of soda, and very weak Condry's solution. Stimulants and nourishing food were given, both by the mouth and rectum.

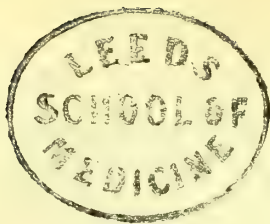
2. John C., æt. 3; admitted 5th January, labouring under diphtheritic croup, accompanied with extreme dyspnœa. Tracheotomy. Dismissed 30th January. Cured.

3. Alex. F., æt. 3; admitted June 1st, suffering from extreme dyspnœa. Diphtheria. Tracheotomy. After the operation, he had repeated attacks of convulsions, with squinting. Dismissed 30th June. Cured.

4. J. B., æt. 4½; admitted 12th June, with great dyspnœa. The whole of the fauces covered with false membrane bled when touched. Tracheotomy. This patient went on most favourably until the 20th. Symptoms of paralysis of the pharynx and glottis occurred. She was fed by the stomach-pump twice daily, and by enemata. The prostration, however, increased, and she died on the 26th June.

Remarks.—In A. F., the false membrane formed below the

tracheal opening, and led to such serious dyspnœa, that the tube had to be withdrawn, and the trachea cleared of the deposit as thoroughly as possible. The patient was a very stout, healthy child, and was able after the second day to cough up the membrane through the tube. He was repeatedly placed in a hot bath, on account of several attacks of spasmodic dyspnœa ; great relief was experienced, and he slept quietly for hours afterwards. As a certain amount of thickening continued in the air-passages beyond the usual period, the tube could not be completely dispensed with until the beginning of the third week. John C. was, likewise, a stout healthy child ; he had not a single unfavourable symptom after the operation. The condition of the wound in Ann A., which is termed in the report "sloughing phagedæna," larger experience has shown me to be really diphtheritic.



LECTURE CVIII.

Injuries and Diseases of the Thorax : superficial and deep-seated — Diseases of the Clavicle—Excision of Clavicle—Excision of Scapula—Diseases of the Mammæ : Abscess ; Hypertrophy ; Tumour—Excision of Mamma.

Fracture of the Ribs : Diagnosis ; Treatment—Emphysema—Wounds of Thorax : method of examining them ; Dangers and Complications attending them—Pneumothorax, Hæmatothorax, Hydrothorax, and Emphysema : their Symptoms ; Treatment.

PASSING from the cervical region, I now proceed to consider the INJURIES AND SURGICAL DISEASES OF THE THORAX, and the operations required for their relief.

This region, for the purpose of distinction, may be divided into the superficial pectoral, and deep or proper thoracic regions. In the former, I must also include the axillary space situated between the thorax and upper extremity. In the superficial region we meet with a great variety of morbid growths requiring surgical operations for their removal. In the case of axillary tumours, their relation to the important vascular and nervous structures contained in that space renders it necessary that the surgeon be exceedingly careful in his diagnosis and in his operative proceedings, almost as much so as in the case of deep cervical growths. I have had occasion to remove the whole of the great pectoral muscle from its thoracic and clavicular attachments to its insertion into the humerus, on account of a medullary sarcomatous tumour developed in its structure. The coraco-clavicular aponeurosis was almost destroyed by pressure of the growth, and the axillary vessels and nerves were fully exposed during the dissection. In another case, I removed an enormous malignant cystic tumour occupying the axillary cavity, and pushing aside the scapula behind and the pectoral muscles in front. I need hardly say the dissections in such

cases are attended with great danger, and must be carefully and quietly proceeded with ; and in the axilla, the loose connections of the cellular tissue should be separated with the finger, and the knife used sparingly after the first incision, which should be very free, so as to divide the axillary fascia, and expose fully the surface of the growth. Smaller firm tumours under the pectoral muscles can be readily removed. Here, as in the case of deep cervical growths, no special rules can be given ; each case must be studied, and the anatomical knowledge and skill of the surgeon must guide him in planning and executing the operation.

EXCISION OF THE CLAVICLE may be required for tumour or other diseased condition of the bone. If the tumour be malignant, or of doubtful character, the whole bone should be removed. In other cases, the external or internal half of the clavicle may be excised. Removal of the entire bone is perhaps the easier operation, for, by disarticulating it at its junction with the acromion, we obtain a longer lever to draw it away from the vessels, and by keeping the edge of the bistoury towards the bone, the vessels run less risk of injury. In a case in which I required to excise the internal half of the clavicle, the bone had given way about an inch and a half from its acromial extremity ; and from condensation of surrounding structures, I found it very difficult to get the bone drawn forwards, even with a pair of strong tooth forceps. In that case, the bone was very irregular on its deep surface ; and, on its removal, the motion of the subclavian artery could be seen, the vessels being only covered by a thin layer of cellular tissue. The disarticulation of the sterno-clavicular joint has been generally regarded as the greatest danger in the operation ; and no doubt the close proximity of the innominate vein and great arteries at the root of the neck, requires that the surgeon should proceed very warily at the moment of disarticulating. At the same time I scarcely think the risk is so great at this part of the operation as in clearing the deep aspect of the clavicle, where it lies in

relation to the subclavian artery and vein. At the sternal articulation, the sterno-hyoid and thyroid muscles, and their fascial covering, intervene between the joint and the vessels; and if the rhomboid ligament, connecting the clavicle with the rib, be thoroughly divided, and the articulation opened in front, we can twist round the articular end of the bone, so that, by keeping the edge of the knife cutting upon it, the remaining texture can be divided without much risk. We may complete the disarticulation with a probe-pointed knife, if that be thought necessary.

Keeping in mind these details, the general method of performing the *Operation* is as follows:—An incision is made upon the clavicle along its whole length, if the entire bone is to be removed; or, in cases of partial removal, to beyond the point where the section of the bone is proposed. At each end of this incision two short perpendicular incisions are made, and the attachments of the sterno-mastoid and trapezius muscles, superiorly, and those of the pectoral and deltoid inferiorly, together with the other soft parts, are dissected from the clavicle. In the case of excision of the entire bone, its acromial articulation is opened, and the clavicular attachments of the conoid and trapezoid ligaments divided. Then, by means of a pair of strong tooth-forceps, or the lion-forceps, the acromial end of the bone is elevated, so as to allow the subclavian muscles and other deeper attachments of the bone to be safely divided. In this stage of the operation the operator should keep the edge of his knife directed towards the lower surface of the clavicle, so as to cut the textures upon the bone, and avoid risk to the subclavian and supra-scapular vessels, which are in close proximity; and as the textures are divided, the clavicle is gradually drawn more forwards, away from the chest as it were, still further to secure the safety of the vessels. The costo-clavicular ligament, at the sternal end of the bone, must be thoroughly divided, and the sterno-clavicular articulation freely opened in front; then, by using the now loosened clavicle as a lever, its sternal articular extremity can be

twisted round so as to divide the remaining ligamentous attachments, and complete its disarticulation without risk to the great vessels at the root of the neck. The difficulty and danger of the operation cannot be estimated by operating on the dead body ; the irregular form of the diseased bone, or the bulk and shape of the tumour, or condensation of surrounding textures in the diseased state, being the chief sources of difficulty in performing the operation on the living. (See Clinical Cases.)

EXCISION OF THE SCAPULA may be required on account of fibro-cartilaginous, or medullary sarcomatous tumours of the bone. I have already spoken of removal of the scapula along with the arm, but excision of the bone, leaving the upper extremity, is a more difficult, and in some respects, a more serious operation. The incisions of the integuments may require to be varied in different cases. In one case, when I had removed a large medullary cystic tumour from the axilla, I found the subscapular fossa affected by a similar growth, although the posterior aspect of the bone presented no appearance of disease. In that case, having already made a free incision in the axillary space, I made an incision from over the acromial end of the clavicle backwards along the spine of the scapula to beyond its base, and dissected back the large flap so marked out. I then divided the attachments of the trapezius, deltoid, rhomboid, and levator angulæ scapulæ muscles, and cut through the clavicle near its acromial end. The scapula was then drawn backwards and outwards, disarticulated at the shoulder-joint, and the operation completed by dividing the serratus magnus. Under ordinary circumstances, I would, after making the incisions through the skin, begin by dividing the clavicle a little internal to the attachment of the coraco-clavicular ligament, so as to enable an assistant to command the circulation, and so prevent the gush of blood which follows division of the subscapular artery. As to the lines of incision, I have said they must be varied in different cases ; but, in general, the best method is to make one long incision

from over the external third of the clavicle, backwards along the spine of the scapula, to beyond its base or posterior margin. From over the acromio-clavicular articulation another incision should be carried downwards to beyond the inferior angle of the scapula, or beyond the lowest part of the tumour. Then the flaps so marked out are dissected back, the clavicle divided internal to the coraco-clavicular ligament, the scapular attachments of the deltoid and trapezius divided, and the humerus disarticulated. The great vessels being now commanded, the remaining muscular attachments of the scapula to the trunk are divided, and the operation completed. After all bleeding is arrested, the incisions are united by silver sutures, and the elbow supported by a handkerchief, a flat pad placed in the axilla, and the arm bandaged to the side.

There is, perhaps, no organ more frequently the subject of surgical treatment than the female breast. As the result of lactation, or other causes of irritation, ACUTE AND CHRONIC MAMMARY ABSCESSSES arise in or beneath the breast, and require to be opened early and freely to prevent the formation of troublesome sinuses. The incisions made to evacuate the pus in such cases, should be free ; nothing can be more cruel than to make a small puncture or inadequate opening, squeezing out the pus, and then requiring to enlarge the opening, or make other incisions to give free vent to the matter. When the abscess is near the nipple, the incision should be made obliquely and parallel to the nipple ducts, so as to avoid cutting any of them across. In some instances the purulent collection is situated under the gland, in such cases the collection should be compressed so as to make it project towards the lower border of the breast, if possible, and an incision made into it along the lower margin of the gland ; by this means the matter gets easier exit, and the mamma is not interfered with.

The mammary gland is also liable to HYPERTROPHY, and when discutient remedies fail, this may require an operation

for its removal ; but, unless the distress caused by the bulk be very great, an operation should not be urged.

IRRITABLE MAMMA is another condition in which the surgeon is not unfrequently urged by patients to excise the gland ; but it is purely a neuralgic affection, and the pain is almost certain to return in the cicatrix if the operation be performed, and hence our treatment should be constitutional rather than local.

When lecturing on tumours, I have indicated the principles on which we should proceed in dealing with the different forms of tumour in this and other organs, and I pointed out that in doubtful cases, where there is a want of distinct definition, or when the patient is of such an age that the function of the gland has ceased, complete removal of the whole breast is the proper method of procedure. In the male we also occasionally meet with tumours of the breast requiring removal by operation.

The usual method of performing EXCISION OF THE MAMMA is by means of an elliptical incision, placed nearly parallel to the fibres of the great pectoral muscle. The patient being placed recumbent, the arm is separated from the side to render the pectoral muscle tense. The operator, holding the breast upwards so as to stretch the skin, first makes the lower incision at some little distance below the nipple, then draws down the breast and makes the upper incision above the nipple so as to complete the ellipse. Care should be taken to preserve sufficient healthy skin to cover in the wound. The integuments are next dissected off the tumour. The dissection is then carried deeply through the fascia, covering the pectoral muscle and that fascia together, with the tumour dissected off from the muscular fibres. Should the tumour implicate the muscular fibres, they must also be removed. If any axillary glands are affected, the lower incision is carried outwards and upwards, the axillary fascia opened, and the gland seized with a vulsellum, carefully dissected or twisted out with the finger. The bleeding vessels are tied or twisted, and when this has been effected, the surfaces both of the tumour

and wound should be carefully examined before closing the wound, to make sure that no portion of diseased texture is left. The surface of the wound is cleansed by pouring tepid water freely over it, and then the margins of the incision are approximated and retained by silver sutures. I generally insert three or four sutures very deeply and at some distance from the free margins and other intermediate points of suture between these, to unite the margins very exactly. A narrow piece of gutta-percha tissue is fixed over the line of incision by means of chloroform, and a soft towel folded flatly, and supported by a broad bandage, is applied for the first twenty-four hours. Afterwards no dressing should be applied to the wound, which generally heals throughout its superficial extent at least. In my own practice I usually leave the axillary end of the incision open, to allow the serous or bloody discharges to escape, and so prevent the formation of abscesses subsequently.

In many cases, owing to the form of the tumour to be removed, we may require to make our incisions in a different direction. Incisions directed from above downwards and outwards answer very well. Sometimes crucial or T incisions may be required, but as a general rule, a straight incision from above downwards, should be avoided. After excision of the breast, the arm should be kept close to the side, and all motion prevented.

I shall now direct your attention to the subject of INJURIES OF THE CHEST and their results, and first to FRACTURES OF THE RIBS.—The ribs may be broken at any point, but generally they give way about the angle, or a little in front of it. In old people, where the cartilages are ossified, we sometimes find the ribs broken at the junction between the bone and the cartilage; and in very young children, where the union is not quite complete, separation occurs at the same place. These injuries generally arise from direct violence. The patient complains of pain in breathing and on attempting to cough. There is seldom any projection at the fractured point, unless the fracture be a very severe one, and hence we require to take some care in

diagnosis. The best method is to ascertain exactly where the pain is referred to, and this will guide us generally to a point at or near the fracture. Then, by moving the corresponding rib, we feel for crepitus, which can usually be detected easily, or we may place the hand over the suspected part and make the patient take a deep inspiration, so as to expand the chest, and thereby produce crepitus. A fracture near the angle of the rib is said to be more difficult of detection, but I think it is not so, for if we move the affected portion of the rib by pressure anteriorly, we can elicit crepitus very easily. Sometimes the fracture may be indicated by another symptom. There may be scarcely any displacement, but we may find some emphysema present. This could only occur from a portion of the rib injuring the pleura and the lung, and causing the air to escape from it into the loose cellular tissue around the fracture. If emphysema be present after an injury of the chest, even though we cannot detect crepitus, we may be pretty sure that there is a fracture of one or more ribs. The presence of emphysema cannot be accounted for in any other way, unless there be an external wound.

When several ribs are broken, the diagnosis is very easy, but the injury is a serious one, and the prognosis bad. I, however, recollect one case in which the sternum was broken across, the cartilages thrown forwards, and several ribs fractured, in consequence of a railway accident. This injury was accompanied with effusion of blood internally, and some emphysema. The patient's pulse was very weak, and at first his case seemed hopeless, but ultimately he made a good recovery, and retained no trace of the injury save some slight deformity of the chest.

In cases where we have any doubt as to the diagnosis, we judge from the history. If a person receives a blow on the side, and complains of great pain on breathing, the safest plan is to assume that a fracture is present, though we may not be able to feel crepitus.

The best *Treatment* either for a bruise on the chest or for a fractured rib, is to put a broad bandage round the chest to control the movements of the ribs. Sometimes a broad cotton

roller is put round the chest several times ; but it is better to use a very broad flannel bandage, and pin it firmly, for we do not want to interfere with the breathing, but merely to confine the respiratory movements within certain limits, and to support the broken bone. If we use an ordinary roller, we are apt to press too firmly on one portion of the rib, and so do more harm than good. When several ribs are fractured, the same treatment is required, but the bandage must be applied more firmly. Along with this local treatment we should give opiates and ipecacuanha to allay the cough and irritation, but not antimony, as it is apt to cause vomiting. If there be much pain in the chest, venesection should be had recourse to ; for if there be much congestion, especially in healthy patients, a moderate amount of depletion will relieve it, and really with less loss of vital power to the patient than would accrue from a long course of depressing remedies internally.

Fracture of the ribs, as well as some other injuries of the chest, may give rise to the condition known as EMPHYSEMA. Two or three ribs are broken, for example, and comminuted, without any external wound being present. A portion of a rib is projected inwards, tears the pleura, and wounds the surface of the lung : the air-vessels are opened into, and the air escapes. If the wound in the lung be considerable, the air escapes pretty rapidly. It passes into the pleura very readily, then into the intercostal spaces, and thence is diffused into the subcutaneous cellular tissue over the chest. There is air over the surface of the fracture—it extends into the axilla, and passes up around the pectoral muscle into the neck. The neck, face, and axilla, become distended, also the front of the abdomen, the sides, the back, the scrotum, and the lower extremity ; in fact, the external surface of the subcutaneous cellular tissue is blown up by the air which escapes. This does not happen often to the full extent I have stated, but the following sketch is not altogether a fanciful case. I recollect the case of a child, about five or six years old, who got several ribs broken : the whole body became much swollen—the face was enormously dis-

tended, and also the neck, chest, scrotum, and extremities. Percussion gave a tympanitic resonance, as if a drum had been struck. Such a case is an extreme one, but the same condition may occur more slowly, and to a less extent, giving rise to serious danger. The same principles of treatment are required in either case. It is sometimes recommended, in incipient stages of emphysema, to bandage the patient so as to prevent the air from spreading all over the body; but if the air does not get to the cellular tissue, it accumulates in the pleura, and the more dangerous condition of pneumothorax will occur. It is therefore better to allow the cellular tissue to get distended, than to run the risk of letting the air collect in the pleura.

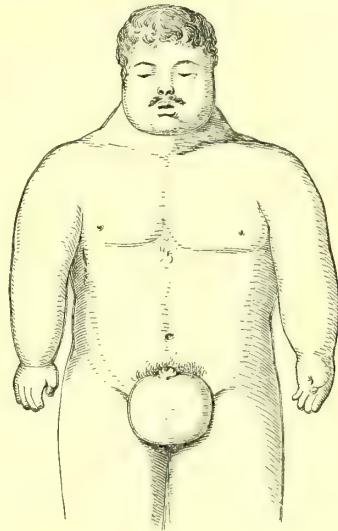


Fig. 34.

The *Treatment* of emphysema, when there is no external wound, is to refrain from bandaging at first. We always have more or less pneumothorax present, and the lung is partially collapsed. But such collapse is rather beneficial, for it allows the injured lung to rest; the circulation through it is diminished; the wound, if small, is glazed over by plastic exudation, and the further escape of air is prevented. In cases of slight emphysema, little or no treatment is necessary beyond that required for the fractured rib.

In other cases, when the emphysema is extending, and where respiration is affected, we make small incisions through the skin wherever the air is collected in the cellular tissue. Several of these are made over the whole body, and through them the air escapes very readily. The tension, pressure, and difficulty of breathing, become less, and the air in the pleura also becomes

diminished, for it escapes less directly and gradually as the air in the cellular tissue passes through the incisions. Hence, in all cases, I recommend making small incisions or punctures in different parts of the body, wherever the air is infiltrated, so as to let the air in the cellular tissue escape.

If a person receives a *WOUND OF THE THORAX* implicating the lung, when that organ is expanded in the act of inspiration, the lung does not collapse. Indeed, it being inflated, often projects, so as to form a hernia of the lung. In such cases, the air entering by the air-passages into the distended lung counteracts the force of the air entering by the wound, which is doubtless greater in amount, but still not sufficient to cause the lung to collapse. If, however, we have an external wound, and at the same time a wound of the lung-substance, such as might be inflicted by the stab of a knife, then we can easily understand how collapse will take place ; because the air entering by the mouth escapes by the wound of the lung into the pleura while the air entering by the external opening rushes into the pleura at the same time, thus causing almost complete collapse of the lung.

A certain amount of bleeding takes place in these injuries, and if we close the wound, as is sometimes recommended to be done, the lower part of the cavity of the chest becomes distended. This causes difficulty of breathing. The upper part of the chest has a resonant tympanitic sound on percussion, and the lower part a dull sound, for the blood from the wound falls towards the lower and back part of the chest, where it collects, and presses down the diaphragm to some extent. In the upper part of the chest the air which has escaped from the air-vessels is collected. If we see a case of wound of the chest immediately after the injury is received, then, if there be no wound of the lung-substance, it will be advantageous to close the wound at once, but when the lung itself is also injured, the proper plan of treatment is to leave the wound open, so as to allow the escape of the blood, as it is impossible entirely to con-

trol hæmorrhage, and also to allow the air to escape, and so let the lung collapse. The circulation in the lung is thus diminished or interrupted, and the hæmorrhage from the wound in its substance is thereby arrested; we give time for the parts to glaze over, and for the air-vessels to close up by the effusion of lymph. The blood-vessels become closed, while the lung is collapsed, and then after thirty hours or so, if there be no contra-indication, we may close the external wound. The lung will in all probability gradually distend again; but even if it does not, there will be no interruption to the action of the opposite lung, and no displacement of the heart and blood-vessels. This, I think, is the proper treatment, the principle of it being, to give time for the parts to be glazed over, before closing up the wound.

I generally lay the patient on the wounded side; this allows the discharges to escape, and then the parts are so placed that the air can pass out, though more air cannot readily get in. I also place a thin slip of oiled muslin over the opening, arranged as a valve, to allow the escape but prevent the entrance of air. At the same time some support should be given to the chest by a bandage. The general treatment must also be attended to, as there is a risk of pleuritis coming on, and opiates should be given to allay the pain and irritation. When much blood has been lost, support the patient's strength, but do not give diffusible stimulants, which are apt to excite irritation and inflammation in the parts.

The method of examining wounds of the chest and abdomen is important; for there is sometimes much mischief caused by not attending properly to this point. As the great danger lies in the fact of the wound being a penetrating one, the risks are very much increased, if, as often happens, the surgeon is too anxious to make out clearly at the very first, whether the wound is penetrating or not. In many cases there can be very little doubt, from the markedly sunk and depressed appearance of the patient, the irregularity of the pulse, and the state of the respiration. If the lung be wounded, there will be more or less bloody sputum, though this may not appear at first, if only

the extreme ramifications of the bronchi be wounded; but as the cough becomes more frequent, instead of the rusty sputum of pneumonia, there is bloody sputum. The wound, however, may not be a penetrating one; but if the surgeon be over-anxious to make a correct diagnosis, and use the probe freely in a wound of this kind, where the parts closing the cavity are naturally thin, and where the wound may have penetrated all but through the pleura costalis, he will probably convert it into a penetrating wound. Hence I think that in such cases it is better to wait a little and take the indications of the symptoms as to the character of the injury.

If the wound be a penetrating one, with any lesion of the viscera, the symptoms will soon be very marked, and will leave us in no doubt as to its nature and the danger attending it. If it be a very slightly penetrating wound, and if the bad symptoms do not come on, the patient is all the better for not having it probed and interfered with. In most cases we find that in penetrating wounds of any importance, unmistakable evidence soon appears as to their character, and therefore we may rest satisfied without being too anxious to examine and ascertain their depth at first. We may examine the weapon which inflicted the wound, to gain some idea of the depth, but not the wound itself, for that involves risk to the patient. So also in fracture of the ribs, we examine them as already described, but do not manipulate and poke about the chest, for by pressing in on the fractured rib we may thrust the broken ends through the pleura, and do much more harm than good. If we are in any doubt, it is better to treat the case, as if it were one of simple fracture of the rib. I think that when an accurate diagnosis is necessary in reference to the treatment, or when our examination is attended with no risk, we ought to be most exact in our diagnosis; but where the knowledge, whether it is a penetrating wound or not, makes no difference in the treatment of the case, we should not incur risk to make out the nature of the injury. The treatment in every case ought to be the same as if the wound were a penetrating one: use all precautions to keep the patient at rest, give opiates and de-

plete if necessary, to allay the irritation and pain which are present.

As a result of injuries of the chest, dangerous conditions may arise from embarrassment of the functions of respiration and circulation. Besides the acute inflammatory affections of the pleura and lung substance, the conditions which the surgeon is most frequently called on to treat are—Pneumothorax, Hæmatothorax, Hydrothorax, and Empyema. As these conditions, though very different from each other pathologically, all act mechanically by compressing or displacing the thoracic viscera, they have certain symptoms in common which we shall first consider before speaking of these different conditions and their treatment. In all of them we have great oppression of the breathing, congestion of the face and neck at first, especially on the affected side, difficulty of lying on the sound side, weak and irregular pulse, and restlessness from threatened suffocation. These symptoms depend upon the pressure of the air or fluid within the pleura compressing the lung, and, as it accumulates, displacing to some extent the heart and great blood-vessels, interfering with the action of the diaphragm, and gradually affecting the action of the opposite lung when the patient tries to lie on the sound side. The correct diagnosis between the different pathological conditions is partly arrived at by physical examination, and partly by the history of the case and symptoms which may have preceded the formation of the collection. The distinction between pneumothorax and collections of denser fluids is easily enough made out by percussing the chest, the clear tympanitic sound leaves us in no doubt. But in regard to the other states mentioned, the effused fluid, of whatever kind it is, leads to dulness on percussion and the absence of respiratory sounds on that side of the chest, so that we must take into account the period after the injury at which the symptoms arise, and the presence or absence of premonitory fever and rigors. When the symptoms arise immediately or shortly after the injury, they are due either to pneumothorax or hæmatothorax, and percussion will determine which of these is present. Hydrothorax or empyema again, are the secondary

results of inflammatory action, and the general symptoms, especially the rigors and hectic, usually present in cases of empyema, will distinguish that from simple hydrothorax.

By the term PNEUMOTHORAX is meant the distension of the cavity of the pleura with air, and this may arise either from injury or from disease of the lung; but it is with the condition as it occurs from injury that we have at present to do. The escape of air, from a wound of the lung, into the pleura, or the entrance of air from without, occasionally follows penetrating wounds of the chest. But the cases in which the pent-up air distends the cavity of the pleura, causing collapse of the lung, and oppressed respiration and circulation, are those of simple fracture of a rib, where a sharp point of the broken bone has punctured the pleura and lung-substance, and wounded some air-vessels. In such cases the small and possibly oblique wound of the pleura-costalis and intercostal textures does not permit the air to escape from the chest into the superficial cellular tissue, as in the case of extensive fracture, where we have emphysema with some pneumothorax. The air therefore escapes from the injured lung, until it collapses, and accumulates in the shut sac of the pleura; and thus we have the interference with the circulation and respiration. The symptom which distinguishes it from hæmatothorax is the clear tympanitic sound on percussion. The respiratory murmur is lost, but the sound of the air entering the large bronchi at the root of the lung is preternaturally loud. The circulation is less speedily affected than in hæmatothorax, because here there is no loss of blood from the system, and also because the displacement of the heart and great blood-vessels is seldom so great as in the case of distension by effused blood or other fluids, such as serum or pus.

As regards TREATMENT, unless the general symptoms be very urgent, it is well to wait a little before drawing off the confined air, so that the wound of the lung-substance may be closed by lymph or coagulated blood, which will serve to prevent the

escape of air when the lung again distends on inspiration. The operation of extracting the confined air is effected by puncturing the thorax at the usual point of election, using for this purpose either Bowditch's apparatus or a trocar and canula, with a stop-cock connected with an india-rubber bag, so as to obviate any air entering from without. As the air is drawn off, the patient is desired gradually to distend the lungs, and when all the air has been extracted, the assistant is ready with a piece of oiled lint to place over the aperture as the surgeon withdraws the canula, then a fold of lint is placed over the part, and supported by a broad flannel bandage. I have already, when speaking of emphysema resulting from fractured ribs, stated what I consider the safest method of procedure for both relieving the emphysema and any pneumothorax which may be present in such cases.

Oppression of the lung, arising from effusion of blood into the cavity of the pleura, is termed HÆMATOTHORAX ; it generally arises as a primary condition, either from a wound of the intercostal vessels or from a wound of the lung-substance. If we suspect that the bleeding is entirely due to a wound of some of the intercostal vessels, then the best treatment is to dilate the wound with a probe-pointed bistoury, feel for the bleeding point, and try to arrest it by tying the vessel. This is not easily done, even when the bleeding point can be felt. Where we cannot get the thread round the vessel, it has been proposed we should introduce a dossil of lint within the cavity of the chest ; and, by means of a thread fastened to it, draw it outwards towards the ribs, so as to fix the lint against the wounded point and keep up the pressure, but this just acts as a foreign body and is apt to lead to serious irritation, and may even cause pleuritis and suppuration in the cavity of the chest. In most cases, by passing an aneurism-needle so as to include the vessel on either side of the bleeding point, we can secure it by small silk ligatures.

The *Treatment* of hæmatothorax, arising from wound of the lung, has been already mentioned ; any blood which has escaped should be removed by an exhausting syringe from the cavity of

the chest, for if left it is apt to become decomposed and give rise to bad symptoms.

As a result of inflammation from wounds, or after pleuritis, the surgeon may be called on to operate for removal of the serous or purulent fluid from the chest. This operation is termed *Paracentesis thoracis*, and is a very simple one when done for the removal of serous fluid, and it may be repeated without any danger. In most cases we find the pleura somewhat thickened, and it requires some little force to push the trocar through it, but there is no danger in the operation. The point of election is generally between the sixth and seventh ribs, about midway between the sternum and the angles of the ribs ; when the chest is very much distended with fluid there is no great risk, for the fluid lies between us and the contained viscera. Guthrie, in his book *On Wounds of the Chest*, says that he has often punctured for fluid below the tenth rib, and to avoid the curve of the diaphragm, he punctured far back ; but the objection to this is that the fluid sometimes does not penetrate so far down, besides in every case the diaphragm rises up again and forms a sort of convexity towards the thorax, and we might puncture the diaphragm with the trocar in carrying it forwards, hence I think it is safer to puncture higher up—about the seventh rib. The trocar used is a very small one ; it is pushed into one of the intercostal spaces, somewhat nearer the upper edge of the rib than the lower, for fear of wounding the intercostal artery—the trocar and canula are pushed inwards, and then the fluid is withdrawn. A small exploring needle may be used ; this allows the fluid to escape slowly. Air is occasionally apt to enter the wound. A method which I used to employ was to put a piece of damp muslin over the orifice of the canula ; the fluid of course presses it outwards ; but when the air attempts to enter, the muslin is pressed inwards, so that no air can get in. A good trocar and canula, fitted with a stop-cock and india-rubber tube, however, answer better. The exhausting syringe also may be used, but great care is required in using it, for if the stop-cock be turned the wrong way, the air enters very rapidly :

it does very well for hydrothorax, but not for thick purulent collections in the chest. Percussion does not indicate the nature of the contained fluid, the sound being dull in all cases, whether serum, pus, or sero-purulent fluid be present ; and we must, therefore, judge from the history of the case. If rigors and fever have preceded the formation of the fluid, or if it has followed a wound, we may be tolerably sure that we have to deal with empyema and not serous fluid. We may have the pus, as in all other chronic abscesses, more or less irregular, and varying in its consistence. Empyema is, in fact, just an abscess within the pleura. When the fluid is equable and tolerably thin, we can draw it off by a trocar and canula, as in hydrothorax, but sometimes we find that, after taking away some of the fluid, the instrument becomes choked ; a piece of lymph or curdy pus has entered the canula and plugged it up. Whenever we find that the pus is of an irregular consistence, with flakes of lymph in it, we should cut down upon the intercostal spaces and penetrate the chest by the old operation for empyema. This is not necessary in hydrothorax, or where the pus is thin, but only where the pus is thick and irregular. The incision through the intercostal spaces is made midway between the ribs, or rather nearer the upper margin of the lower rib than the lower margin of the upper rib. The skin is first drawn up and rendered tense, so that when it relaxes afterwards, it forms a sort of valve over the wound. In other words, the wound of the surface is made so that it may not correspond to the deep wound. The surgeon then cuts down upon the intercostal muscles, and divides them till he sees the pleura, which generally bulges out ; the point of the knife is then entered into it, and some pus is ejected ; then with a probe-pointed bistoury the opening is enlarged, so as to allow the contained pus to escape freely. The lung is in most cases adherent, and cannot distend, though it tends to do so ; the air entering has still further a tendency to cause the lung to collapse. All the thick part of the pus can be drawn off in this way, much better than by the trocar and canula. When the surgeon uses the trocar and canula to draw off the fluid, and finds that he cannot draw it all off, he should leave in

the canula, and use it as a sort of director, and enlarge the aperture by an incision on either side of the canula, and so give vent to the fluid. When the operation is completed, the skin which has been drawn up falls down and closes over the wound, forming a sort of valvular covering. Then a compress of oiled lint is placed over the wound, and supported by a broad flannel bandage.

CLINICAL CASES.

THORACIC REGION.

DISARTICULATION OF THE STERNAL HALF OF THE CLAVICLE.

G. L., labourer, forty-eight years of age, and of strumous habit, had suffered for a length of time from epileptic fits, consequent upon an injury of the head, received eleven years ago, by a fall from a height, and the whole of the sternal half of the bone was much enlarged and of irregular form. In the beginning of December 1847, he was seen by Mr. Falconer, Loanhead, on account of an abscess which had formed towards the outer part of the clavicle. This abscess was opened, and although the matter discharged was thin and unhealthy, no diseased bone could be detected by the probe. The wound healed in about a fortnight or three weeks. Shortly after it had cicatrised, the patient fell down in one of his epileptic fits, and on recovering he found a thick but sharp-pointed portion of the clavicle projecting through the thin recent cicatrix. Mr. Falconer states, that the projecting portion of bone was of diseased appearance when it first protruded; and when I saw it, about a week afterwards, in the beginning of January 1848, the exposed portion was rough and apparently carious. After this, although the parts were kept in perfect rest, abscesses formed at various points near the clavicle, about the root of the neck, and in the supra-clavicular space in the vicinity of the subclavian vessels; also above the sternum. Near the sternum there was a small opening, through which the bone could be felt rough and bare; and the other abscesses, although the probe could not detect any direct communication with the diseased bone, evidently depended upon the irritation excited by its presence. I saw the patient two or three times after this, but the exposed portion of bone did not become loose; and it resisted every effort to detach and remove it.

After waiting for nearly three months in expectation of some necrosed portions becoming loosened by the natural process, but finding it still impossible to detach and extract it from the rest of the bone, whilst the man's health was rapidly sinking under the constant discharge and hectic, I proposed the removal of the whole internal half of the clavicle from its sternal articulation, so as to include all the diseased bone, to which proposal the patient at once assented.

On the 11th April 1848, I proceeded to excise the diseased portion of the clavicle, assisted by Messrs. Goodsir and Falconer, and in the presence of Dr. Smith, Messrs. Harvey and Edwards. Chloroform having been given, I made an incision about three and a half inches along the inner half of the clavicle, commencing about four lines internal to the sternoclavicular articulation, and then made a perpendicular incision about an inch and a half in length across the former, at the point corresponding to

the sterno-clavicular articulation. The clavicular attachments of the sterno-mastoid and pectoralis muscles were next divided. In doing this there was pretty smart hemorrhage from numerous small vessels. I now divided the clavicle a little external to the exposed diseased portion, and tried to raise the divided extremity so as to pull it forwards from the great vessels. I found, however, that I could not effect this, owing apparently to some muscular attachments which had not been completely divided; these I divided fully, when I could see the bone thickened and irregular, owing to the deposition of new bone. I then dissected around this carefully; and Mr. Goodsir attempted to draw the bone forwards, by means of a pair of strong tooth-forceps, which I had brought on purpose, in case of difficulty. The dense and firm structures, however, prevented it being raised, so that I had to dissect the extremity of the bone cautiously, as the condensation extended as far inwards as the position of the great vessels. Whenever the mass of condensed tissues was wholly divided, the bone was raised and drawn outwards and forwards from the chest; then, by keeping the edge of the bistoury directed obliquely towards the clavicle, I divided the rhomboid or costo-clavicular ligament, and the other remaining attachments, and by using the free portion of the clavicle as a lever, I was enabled to disarticulate it readily from the sternum. Although there had been smart bleeding during the performance of the operation, only three small vessels required ligature. The consolidation of the parts, and the diseased state of the skin, prevented the greater part of the edges of the wound being united by suture, and in the site of the removed bone there remained a very ugly-looking fossa, in which the pulsation of the great arteries could be seen and felt. This cavity was filled slightly with charpie, and supported by a bandage. After the patient was placed in bed, and had recovered from the effects of the chloroform, an opiate draught was exhibited.

I saw him again on the 15th of April, when he was suffering from an attack of bronchitis, to which he had been long subject. He had a constant harassing cough, but was expectorating freely. The impulse of the coughing was communicated strongly to the wound, which was suppurating freely, and healthy granulations were beginning to spring up. With the exception of the cough, he was going on favourably. Warm-water dressing was applied to the wound, and he was allowed nourishing diet.

As the accounts I received from Mr. Falconer continued favourable, I did not visit him again till the 24th of April. The cough had then almost entirely left him, and he was sitting up with the arm in a sling; the wound was covered with granulations, and contracting rapidly. For a few days previous to my visit, the red lotion had been applied to the wound. From this time I did not see him again till the 7th of May, when the wound had completely cicatrised. Little treatment beyond the occasional application of escharotics to the exuberant granulations had been required: his general health and appearance had much improved, and he now slept well at night, and was free from pain.

I saw him again in September; there was very little falling in of the shoulder of the side from which the clavicle had been removed. His general health continued good, and he had for some months been at his usual employment of a labourer.

Remarks.—The removal of the sternal half of the clavicle in this case was, I consider, sufficiently warranted by the state of the patient, the constitutional irritation he was suffering, and the repeated formation of ill-conditioned abscesses at the root of the neck, and in dangerous proximity to the large vessels. Under these circumstances there was distinct indication for operative interference, either by removing the diseased portions of the clavicle, or by removing the whole sternal half of the bone at the articulation. I preferred the latter operation for the following reasons:—The diseased portion which presented itself was not loose or detached, and the probe introduced through the sinuses detected other altered portions nearer the sternum; so that the full extent of the disease could not be accurately ascertained; and as the character of the disease and state of the patient's general health forbade waiting for nature to throw off the dead portions, it appeared to me that the operation necessary for the removal of such diseased portions would be equally severe, and the effect less certain, whilst removal of the internal half of the clavicle would remove the whole disease; and as the continuity between it and the acromial end was already broken, union being maintained only by ligamentous tissue, the inner half was really of no use to the patient.

The difficulties which in this case rendered the operation more protracted than I expected from numerous trials on the dead body, were owing principally to the previous disease having caused great alteration in the parts around the bone; these were condensed, and their appearance, relations, and attachments altered close to the position of the subclavian vessels. The firmness of the new attachments prevented the clavicle being drawn forwards from these vessels, and rendered a cautious dissection necessary to free that portion of the bone, the altered and irregular form of which, from the deposition of new osseous matter, was also a cause of difficulty, as it prevented me keeping the edge of the bistoury close to its posterior surface. I conceive that stage of the operation the most dangerous; but when the posterior surface of the bone is smooth, or when, after separating

the muscular attachments and dividing the clavicle with the saw, that bone can readily be drawn forwards, and the edge of the knife kept close to the part to be removed, I should think the operation would be both more readily accomplished, and with much less risk.

As to the disarticulation at the sternum, that is effected without much difficulty, for when the incision of the integuments over the joint is free, and the rhomboid ligament attaching the clavicle to the rib wholly divided, the articulation is easily opened from above and anteriorly, and then, by using the bone as a lever, it can be twisted so as to divide the posterior part of the capsule, with scarcely any risk to the pleura or great veins; besides, the strong layer of the deep fascia, the origin of the sterno-hyoid and thyroid muscles, and generally a layer of fat, lie between the knife and these important parts; so that, if ordinary care be taken, they can scarcely be injured; and, if further security were required, the use of a probe-pointed bistoury, to divide the posterior part of the capsule, would, I conceive, preclude any chance of accident in this part of the operation.

CASE OF EMPHYSEMA AND PNEUMOTHORAX FOLLOWING FRACTURED RIBS.

Thomas T—, ætat. 5 years, admitted into the Royal Infirmary June 13, 1857, about 6 P.M., having been run over by a cab a few minutes before admission. One wheel had passed over his neck and the other over his chest, the latter having rested on his body a few seconds, according to the report of the police.

On admission his condition was as follows:—There was great emphysema of face, neck, and upper part of chest, rather greater on right side. There was extreme difficulty of breathing, very great lividity of lips and countenance, and the expectoration was tinged with blood. The larynx and trachea were apparently uninjured. The fracture of the ribs could not be distinguished on account of the great amount of puffy swelling, and the pain caused by any attempt at examination. On percussion of chest both sides were found resonant, but the right side gave a clearer and more ringing note than the opposite side. On auscultation, which was difficult, from the great amount of superficial crepitation and restlessness of patient, the ordinary respiratory sounds were audible over the left side, but considerably exaggerated. On the right side they were absent, inspir-

ation being inaudible, and expiration an abrupt blowing sound, perhaps transmitted from the opposite side.

After lying in bed for some time, the breathing became much calmer and easier, and the lividity of the countenance passed away ; the emphysema, however, increased, and gradually extended over the abdomen and scrotum to the upper part of thigh. In the evening free incisions were made through the skin and cellular tissue, in each axilla, and over the sternum. A large quantity of air then escaped, much to the relief of the patient.

June 14th.—This morning he seems and feels better. He slept somewhat during the night. The incisions have become glazed over with lymph, and the emphysema has apparently increased since they closed.

To-day he was ordered to have several small punctures made to evacuate more air from the cellular tissue ; and the pulse being rapid and the skin hot, he was ordered to get repeated small doses of antimony, 1-10th of a grain every three hours. A considerable amount of air escaped by the punctures. Percussion on right side is rather duller than it was yesterday, and the inspiration is faintly audible. The left lung seems to act freely, the breathing is easy, and the lividity quite gone.

June 15th.—Slept pretty well last night ; emphysema considerably less than it was yesterday, although still considerable over chest, abdomen, face, and arms ; the eyelids are less swollen, and he can open his eyes. The breathing is quite easy, and general appearance much improved. Percussion on right slightly duller than on left side ; right lung seems to have begun to act again, and the respiratory signs are returning. On the left side respiration seems to be going on freely, and the sounds are still slightly exaggerated. Antimonials continued.

June 20th.—The emphysema still continues a little ; slight bronchitis has commenced on left side. The pneumothorax has decreased, and the right lung seems to be acting more freely. The antimonials continued.

June 22d.—Emphysema much better ; the incisions are healing fast ; pneumothorax is disappearing, and the right lung acting distinctly ; bronchitis is much relieved, and the breathing is tranquil and easy.

June 30th.—Has progressed very favourably since last report. Slight emphysema still exists in scrotum.

July 6th.—Is nearly well, except that there is considerable flattening of chest on the right side. The incisions are nearly healed. Dismissed cured on the 18th of July.

This case illustrates the plan of treatment recommended in Lecture cviii. pp. 1113 and 1114.

LECTURE CIX.

Abdominal Wounds: their Nature, Variety, Risks, Complications, and Treatment, General and Special—Traumatic Peritonitis: its Symptoms, Pathology, Prognosis, and Treatment—The Operation of Paracentesis Abdominis: when and how to perform it—Chronic Abdominal Abscess, diffuse and circumscribed—Perityphlitis—Iliac, Lumbar, and Psoas Abscess: Diagnosis and Treatment.

IN WOUNDS OF THE ABDOMEN, as in those of the chest, the danger is great in proportion as the wound is penetrating or superficial; but even in a wound of the abdominal parietes, at certain points there are special risks. Along a certain line we have the branches of the internal mammary artery, and, lower down, the great internal epigastric artery, which may be injured in a non-penetrating wound of the abdomen. The blood may become effused between the fascia transversalis and the peritoneum, or into the sheath of the muscles, and thus a very large amount of blood may be lost, sufficient to debilitate or even to cause the death of the patient. In such cases, of course, the state of the wound, its direction, the general symptoms of hæmorrhage, and the peculiar, low state of the pulse, would indicate what had happened, and then we should enlarge the opening, so as to get at the bleeding point, and secure the vessel by ligatures.

Where the wound is non-penetrating, and no great blood-vessel is wounded, there is still another risk, not immediate, but secondary—the risk that, from the weakening of the abdominal parietes, a traumatic hernia may occur afterwards. The abdomen may be wounded, the wound dividing the fibres of the external and internal oblique and transversalis muscles,

but not injuring very materially the fascia transversalis, and not penetrating the peritoneum. This is strictly a non-penetrating wound. If the fibres be divided more or less transversely, they yield; the action of the diaphragm, and other muscles of the abdomen compress the viscera, they are forced towards the weakest point, and a traumatic hernia occurs. The peritoneum, with a portion of the bowel, is projected through the opening; and hence, although the wound be non-penetrating, there are special dangers attending it connected with the locality in which it occurs. In all such cases, when the wound divides a considerable thickness of the abdominal parietes, we should take means to support that point by a pad and bandage until union has occurred, not only superficially, but at the deep part. After operations, as for ligature of the external and common iliac arteries, the parietes must be weakened; but this cannot be avoided, and we therefore take means to support the weak point, and prevent the risk of a hernia occurring, by appropriate dressing.

The great risk, however, in abdominal wounds is penetration into the cavity of the abdomen, and lesion of some of the contained viscera. Here, as in the chest, we should not be too anxious to make a correct diagnosis at first, by probing, for we may safely trust to the indications which will be given if any lesion of the abdominal organs has occurred. We must be very careful, however, in forming an opinion as to what part of the viscera may have been wounded, for the viscera of the abdomen are subject to great changes in their position, according to their degree of distension. I have seen a wound about midway between the lowest rib on the right side and the umbilicus, where the stomach was injured, which could not happen in ordinary conditions. The wound, however, was received shortly after dinner, when the stomach was fully distended. In a few hours vomiting of blood came on to a considerable extent, and the man died within twelve hours in great agony from acute peritonitis. In this case the distension of the stomach explains the reception of a wound in so unlikely a position. In small punctured wounds we cannot be sure what part is injured,

except, perhaps, the stomach, in which case the character of the vomiting which occurs speedily, shows the nature of the injury.

The principle of *Treatment* is the same in all cases : whenever there is a suspicion that the viscera are wounded, we should give opiates internally, and also opiate enemata. As regards food, the less given the better : ice may be given to suck, but the use of nutrient enemata is perhaps the best method of nourishing the patient for the first day or two. The object is to prevent the peristaltic movements of the intestine, to allow the wound in the viscera to become covered over with lymph, and to prevent the possibility of the parts being distended with food. The risk of internal hæmorrhage cannot be guarded against, the only thing we can do is to apply cold both externally and internally ; but, after all, these are very trivial measures when the vessel wounded is of large size. Sometimes we are able to tie the wounded vessel ; but in these cases the amount of injury done renders the case a very hopeless one. I have seen a case where a portion of the bowel with the mesentery was injured, and branches of the mesenteric artery torn, and here I was able to tie the wounded vessels ; but in such a wound, whilst the surgeon is bound to arrest hæmorrhage and use every precaution, it is evident that the chances of a favourable result are very small.

In some cases of wounds of the abdomen a direct traumatic hernia may take place ; the bowels are protruded through the wound. When this happens, the intestine must be examined carefully to see if it is wounded, and also to see that no arteries are injured. Where a penetrating wound of the abdomen, with protrusion of the viscera, has occurred, we find that in most cases, from the patient falling on the ground, a quantity of dirt and dust has lodged on the surface of the intestines. The intestine must, therefore, be washed to get rid of this, and this is done by pouring lukewarm water very gently upon it, without handling it much, though we may turn over the convolutions of the gut to see if any part of it has been wounded, whether any perforation of the bowel has taken place, or any blood-vessel at the

root of the mesentery been injured. When the intestine is wounded, we may introduce a few points of herring-bone or glovers' suture, if the wound be small.

When the wound is larger, the same suture may be used, but the chance of recovery is much less if we stitch it up and return the bowel into the cavity, than it is if we make an artificial anus, and so allow the fæces to pass by the external wound. A large wound of the intestine is always a most unfavourable condition. If the upper portion of the jejunum be wounded, the prognosis is unfavourable, for then the food is not properly digested, and the patient is likely to die from inanition, and this independently of the peritonitis and other conditions which may arise.

If the bowel is not wounded, it should be returned into the cavity of the abdomen. In returning a considerable portion of the small intestine, there is a very great risk in pushing it inwards, especially if the wound be not very large, that it may be pressed up between the fascia transversalis and the muscles, or between that fascia and the peritoneum. The portion of the intestine is thus pushed back out of sight, apparently within the abdomen, but really external to the deep wound in the peritoneum, which is probably small. The protruded portion of the gut will thus become constricted. Hence we should always follow the intestine with the finger, to make sure that it passes fairly back into the abdomen, for I have seen more than one case in which the above-mentioned accident has happened. If we find, on passing the finger deeply, that the opening in the peritoneum is small in proportion to the mass of intestine protruded, we must enlarge the opening so as to allow the free return of the gut into the peritoneal sac. When the intestine is completely returned, we stitch up the external wound, after having first checked all bleeding from its margins. Then a pad and a spica bandage are applied as after the operation for hernia, so as to support the weak point of the abdomen, and prevent protrusion recurring.

Opiates must be given, to procure rest and allay irritation in

the part which was protruded, and also to prevent the action of the bowels for a time, for if they begin to act soon after the accident, the irritation produced may give rise to acute peritonitis.

In some cases a small portion of gut may be protruded from the deep wound between the muscles or under the integuments, without appearing externally. If not noticed, this may become constricted. In such circumstances the symptoms of acute incarceration, or strangulation of the intestine, will supervene as in hernia; and when there is much pain felt locally, and some fulness near the wound, with vomiting, or tendency to vomiting, no time should be lost in enlarging the wound, to examine and return the gut or omentum if protruded.

PERITONITIS is one of the most dangerous complications of wounds or operations in the abdominal region. The symptoms which indicate it are, great pain, of an acute, burning, and persistent (not spasmodic) character, extending gradually from the vicinity of the wound over the whole abdomen. This pain is greatly increased by pressure over the abdominal surface, or by stretching out the lower limbs. The patient generally lies with the limbs drawn up and the thighs flexed on the pelvis, to relieve tension. The features at first are flushed, and have an anxious expression; the skin is hot and dry, and the urinary secretion diminished. The pulse varies from 98 to 120 beats per minute, and has a hard wiry feel. The tongue is at first of white milky appearance, but soon becomes foul and loaded. As the disease proceeds, the belly becomes tense and tympanitic, and vomiting supervenes, at first of a bilious character, but subsequently of dark greenish watery fluid. When the disease progresses to a fatal termination, the vomiting, or the attempt to vomit, becomes almost incessant. The features become sharp; the pulse increases in frequency, but becomes weak and compressible, and the patient gradually sinks.

The pathological conditions resulting from peritoneal inflammation are, increased serous effusion and exudation of plastic lymph. In the acute sthenic form of the disease, the soft plastic

exudation is thrown out rapidly in large quantities, matting the convolutions of the intestines by adhesion of their peritoneal surfaces, and interfering with their functions. In cases where the acute action is overcome, and the patient survives, the soft recent adhesions gradually become elongated, and of fibrous character. In some forms of peritonitis, and when the action is limited, the surface of the membrane loses its smooth glistening character, and becomes rough and granular from deposit of lymph on its surface, a condition often met with in strangulated hernia in a portion of bowel above the protrusion. In some instances, the very intensity of the action would seem to prevent organic change. Thus, in two cases of rupture of the bladder, where the patients suffered from all the symptoms of intense peritonitis, I found no apparent change in the peritoneum, no increased vascularity, no recent adhesions or flakes of lymph, and no effusion, with the exception of about two ounces of turbid fluid of a urinous odour in the recto-vesical pouch of the peritoneum. It seemed as if the very excess of the disease had so impaired the vital powers as to prevent the plastic or serous effusion taking place.

The prognosis in surgical peritonitis following a wound, or arising during the progress of a hernia, is much less favourable than in ordinary idiopathic peritonitis. The *Treatment* will be modified by the nature of the wound and other circumstances in individual cases, but the general indications are, to allay pain by the exhibition of opium either alone or in combination with calomel, and given at intervals of three or four hours—warm fomentations over the abdomen at and near the wound, and the application of a blister over the belly at a part more remote from the wound. In surgical peritonitis it is not very often that the patient can bear depletion. In cases of wounds the previous loss of blood, and in cases of hernia the exhaustion consequent on the diseased condition generally, contra-indicate it. In some cases, however, of young robust patients, or when the pain is very acute and the pulse hard and firm, depletion by leeches over the abdomen or by venesection may be used advantageously at the early period of the diseased action, but scarcely when effusion or

tympanitis has set in. The use of laxatives must depend on the state of the viscera. In most cases of surgical peritonitis we require to keep the intestines at rest, for a time at least, and therefore we refrain from using this class of remedies.

In your practice as surgeons you will be frequently called on to perform PARACENTESIS ABDOMINIS, for the purpose of drawing off collections of serous fluid in cases of ascites. In the majority of such cases the surgeon is called in by the medical attendant to perform the operation, in consequence of the accumulation of fluid interfering with the respiration and circulation. From the very nature of the originating causes of the effusion in most cases of ascites, tapping the abdomen is had recourse to rather as a palliative than as a curative operation. I have, however, seen some instances where a certain amount of organic affection of the kidney was the cause, and where all diuretic remedies had lost their effect, while the operation of paracentesis not only relieved the patients temporarily, but the medicinal remedial agents seemed to regain their effect, and the action of the kidney was restored; and in some of these cases the patients recovered and lived for years afterwards. These, however, are exceptional cases: in most instances the fluid rapidly reaccumulates, and the operation requires to be repeated from time to time to afford relief. The operation, therefore, should not be hastily performed at first until other remedies have failed to diminish the collection, or when it is interfering with the function of respiration. In all cases the surgeon must satisfy himself as to the diagnosis and state of the patient before operating, for sad mistakes have occasionally occurred. In ascites the fluid collects gradually, and is not confined at first to one side, as in ovarian disease. The abdomen is equally distended throughout, the fluid lying in front of the intestines, except in some cases where previous adhesions limit the fluid in certain directions. In all cases, percussion and palpation of the distended abdomen should be carefully employed, to ascertain whether the swelling is caused by fluid, and also the relation of the hollow viscera in each case,

for the colon has been punctured through carelessness in operating. It sometimes happens that in cases of acute or subacute peritonitis a form of acute ascites takes place; but interference in such cases is generally disastrous. The fluid drawn off forms a gelatinous mass as it cools, and the temporary relief afforded by its removal is soon followed by fresh exacerbation of peritonitis, accompanied with typhoid symptoms. In such cases the symptoms must be very urgent and painful to warrant interference; and from what I have seen I would say it is better not to interfere at all.

When, however, you have satisfied yourself of the propriety of performing paracentesis, the operation, though a simple one in itself, requires some careful arrangement of the patient. If the fluid be carelessly or too rapidly drawn off, fatal syncope might be induced, or distended veins suddenly deprived of the equal fluid, support might give way, and internal bleeding prove fatal. The patient should be seated on the front of the bed, supported by pillows. A broad cotton binder, split at each end into three tails, is placed round the patient, the ends crossed behind, and given in charge to two assistants, who, by drawing in opposite directions, tighten the binder as the fluid escapes, and thus keep up equal pressure on the abdomen during the operation. A longitudinal slit is made in the bandage in middle line, so as to enable the surgeon to ascertain the position of the umbilicus. The point of election for puncture is about midway between the umbilicus and pubis, or rather nearer the umbilicus. In all cases the patient should be made to empty the bladder, or the catheter should be used as a precautionary measure, to ensure the bladder being below the level of the pubis. The operator then enters the trocar and canula exactly in the middle line corresponding to the linea alba, at the point of election already indicated. If he uses a large trocar, he should, as he withdraws it from the canula, place his finger slightly over the orifice to moderate the gush at first, and then the binder is gradually tightened as the fluid is drawn off; and when the operation is completed, the split ends are brought round and pinned in front

to give support. A small piece of adhesive plaster is placed over the puncture, and the patient placed in bed. During the operation a little wine may be given if the patient feels faint ; and he may require to be placed recumbent if very weak.

If the puncture be made at the part of the abdomen I have indicated, bleeding cannot take place, except it be from distended veins, or some peculiar condition of the parietes. I recollect one case in which I was asked to operate, because on a previous occasion, when the patient was tapped, very profuse arterial hæmorrhage had taken place. On the occasion I performed it all went prosperously, but about a year afterwards the woman died, and I was present at the examination of the body. There was malignant disease of the uterus, and the lower and forepart of the parietal peritoneum was covered by a growth of a pulpy or spongy and vascular character, about three-fourths of an inch in thickness. This had been punctured in the first tapping, and my puncture had merely escaped touching it by about half-an-inch. That, however, was the only case in which I ever knew of active bleeding taking place when the puncture was in the middle line. It occasionally happens that towards the latter part of the operation the flow of the liquid through the canula is suddenly interrupted : this is due to some part of the omentum or intestine falling over the orifice. In these circumstances, by a slight change in the position of the patient, or by gently pushing aside the obstruction with a probe introduced through the canula, the flow is re-established.

ABSCESSSES IN THE ABDOMINAL PARIETES require great care to be exercised in their diagnosis, in case they should be mistaken for other diseases, or *vice versa*, and wrong treatment adopted. I have occasionally seen a low form of suppuration over and along the course of the spermatic cord in the inguinal canal, where the progress of the diseased action was slow, and yet attended with great pain and general irritative fever. In such cases the swelling is seen and felt superficially, the pus is deeply seated, and

requires to be evacuated by cutting down upon the canal, as in a case of hernia, to avoid risk.

In the right iliac region we meet with inflammatory infiltration of the loose cellular tissue of the iliac fossa around the caput cæcum, from irritation of that portion of the intestinal canal—PERITYPHLITIS, as it is termed—and this frequently terminates in suppuration, attended with great constitutional disturbance.

We should be very cautious before making incisions in such cases, on the assumption that suppuration has occurred, for in this form of iliac cellulitis there may be great effusion and hardness, with rigors and sympathetic fever, and yet under proper antiphlogistic treatment the general symptoms may abate, and the local effusion disappear, without pus being formed, so that it is well to wait a little for decided symptoms of suppuration before cutting through the parietes.

When an opening is indicated, the incision should be made in the line of Poupart's ligament, near the anterior superior spine of the ilium, unless the abscess be pointing elsewhere, and then we follow the indication afforded by the natural process. The after-treatment is the same as that of an ordinary abscess, only we require to watch lest ulceration of the bowel should occur, and fæcal fistula should form. In cases of circumscribed abscess in the iliac fossa in connection with the intestine, the ulceration is sometimes large, and leads to artificial anus. This form of artificial anus is said to be more difficult to heal than that arising in gangrenous hernia, but my experience of a few cases of this kind, which have come under my own care, is different. They all did well, the opening contracted, and the fæculent matters gradually passed by their natural channel as the wound healed, and no surgical interference was required.

When purulent collections in the iliac fossa on the sub-peritoneal surface of the fascia are chronic and diffuse, they may closely simulate femoral hernia. The internal cribriform fascia in the first instance, and next the external cribriform fascia, yield before the gradual pressure of the pus, and a

rounded swelling is felt at the femoral ring. The swelling is projected more distinctly when the patient coughs, and it communicates a feeling of impulse to the finger. There is no acute pain ; merely uneasiness. When the patient is placed recumbent, the swelling returns into the abdomen, and if the finger be placed over or pressed upwards into the femoral ring, and the patient desired to rise up, the swelling is retained ; but when the pressure of the finger is removed, it again reappears. Now, these symptoms are very similar to those of femoral hernia, but there is usually something in the appearance of the patient, or in the history of the case, that leads us, if we be on our guard, to arrive at a right conclusion. Amongst other diagnostics, I would direct your attention to the fact that in such cases, although we can reduce the swelling readily enough, and can retain it, as already stated, by pressure for a time, yet gradually it descends ; or if a truss has been used, the swelling makes its way from under the pressure, however accurately the truss may fit. In such cases the ordinary treatment of chronic abscess must be had recourse to.

The terms LUMBAR and PSOAS ABSCESS are used to denote subacute or chronic purulent collections arising in the substance of the psoas muscle or the cellular texture around it, and are very generally connected with caries of the vertebræ. Sometimes the collection of matter is somewhat circumscribed, and projects or points in the lumbar region at the anterior free margin of the quadratus lumborum muscle, and then it is termed a lumbar abscess. More frequently, however, the pus burrows down along the psoas muscle into the iliac region, passing below the fascia iliaca, and points at the upper and inner part of the thigh under the iliac portion of the fascia lata, having followed the course of the psoas tendon to its insertion, and in such circumstances it is termed a psoas abscess. In treating this form of abscess, whether we open it in the lumbar or crural region, we must bear in mind that it generally arises in connection with

an unhealthy state of the constitution, and hence that, under any method of treatment, irritative fever may supervene.

When the matter is homogeneous, and not curdy, we may draw off the pus with the exhausting syringe, or with tubing under water, as I described when lecturing on chronic abscess ; but if, as is generally the case, the pus is of unequal consistence, it is better to make a free incision, to permit of the pus being fully evacuated, and in doing this you may use a piece of folded lint, soaked in carbolised oil, laid over the part. The incision should be made through one fold of the lint, and then the other fold allowed to fall over it ; the pus escapes by the sides, or soaks through, and when the pus has all escaped, a fresh piece of oiled lint is laid over the other, and covered with gutta serena tissue, and a soft towel folded is placed over all, supported by a bandage. If any irritation follows, this dressing must be removed, and ordinary poultices applied. Subsequently the cavity may be washed out with weak carbolic lotion, or the chlorinated soda lotion, or watery solution of iodine. When the abscess projects, and requires to be opened in the inguino-femoral region, you must keep in mind the position of the great vessels which are sometimes displaced by the collection ; but the more general risks are injury of the saphena vein, or branches of the inguino-pudic artery, or branches of the internal circumflex artery ; and hence the incisions should be made after careful examination of the prominent part of the swelling, to avoid any large superficial vein, and to ascertain that no artery is felt pulsating at the point you intend to make your incision or enter the trocar.

LECTURE CX.

Hernia : definition of the term—Mechanism of Abdominal Hernia, and Nature of the Protrusion—Formation of the Hernial Sac, and its relations to the Visceral Peritoneum—Structural Changes which the Sac and its contents undergo—the Fascia Propria : whence derived and how distinguished—Contents of the Sac—Enterocoele—Epiphlocele—Entero-epiphlocele—General Diagnostics and Classification of Herniæ : its Symptoms and predisposing and exciting Causes—Mr. Vincent's views on the Action of the Diaphragm—Treatment of Reducible Hernia—Application and Adaptation of Trusses.

IN entering on the subject of ABDOMINAL HERNIA, I cannot help feeling how inadequately I can treat of so important a department of surgery in the space I can devote to it in a course of lectures in which so many other diseases must be considered ; and I feel the difficulty all the more perhaps, because I have had, owing to various circumstances, a larger amount of experience in hernial cases than falls to the lot of most surgeons. This renders the task of condensation more difficult ; for with the practical knowledge that there are scarcely any two cases of hernia exactly alike, and that these individual peculiarities have important bearings on the practice in each case, it is not easy to lay down a few general principles when exceptional conditions are so numerous. The value of experience in such circumstances is rather in regard to details and emergencies in complicated cases. I shall, however, attempt to bring before you, as succinctly as I can some general principles of action embodying and founded on results tested by my own experience.

By the term hernia we mean a protrusion of a part of the viscera through some weak point in the abdominal parietes, generally through some natural canal or opening, which has become dilated, or through some adventitious aperture, caused by separation of aponeurotic fibres, from distension of the abdominal parietes. Except in cases of direct penetrating wounds, pro-

trusion from forcible laceration of the abdominal walls must be very rare, if it ever occurs. Hence the popular term, Rupture, so frequently used to designate this disease, is an improper one, and likely to mislead as to the true state of matters.

I have said that the protrusion usually takes place through some natural opening or along some natural canal. It does so by slowly distending the apertures through which it passes. Or it may happen, that the natural structures passing through a canal, may, owing to disease, become increased in bulk, dilate the passage, and subsequently return to their natural size, or undergo atrophy. In consequence of these changes the calibre of the canal is relatively increased, and a hernial protrusion will be likely to occur. Thus I have known a case in which, after subacute orchitis and swelling of the spermatic cord, having existed for some time, these structures have become completely atrophied, and a hernial protrusion has taken place and become strangulated. The same tendency exists after the cure of cirsocele, where the inguinal canal has been dilated by the varicose veins of the cord. Again, in consequence of continued distension of the abdominal parietes, from any cause, the fibres of the aponeurotic portions become stretched and separated, or apertures for the transmission of blood-vessels may become dilated, and thus weak points are created, through which, under certain circumstances, herniæ may occur. We have examples of these last-mentioned conditions leading to hernia, after ascites, or in females after repeated pregnancies. In such cases the textures which have been temporarily distended become relaxed, and their fibres stretched; and under these circumstances ventral or umbilical hernia frequently occurs, without any rupture of the parietal structures.

Having considered the manner in which hernia usually takes place, I next proceed to point out to you the nature or character of the protrusion. In general terms, a hernial protrusion may be said to consist of some portion of the hollow viscera of the abdomen, or of the floating omentum, or of both, invested by a protrusion of the parietal peritoneum, which is termed the hernial sac. The

nature of the hernial sac, in relation to its contents and the abdominal walls, and the structural changes which it undergoes, are of great practical importance in reference to diagnosis and treatment. We also require to notice the exceptional cases in which the sac is absent. If we examine the interior of the abdomen in its natural state, we observe that the peritoneum is reflected from off the viscera, on the inner surface of the parietes, to which it is closely connected at some points, but more loosely at others, to admit of the varying distension and movements of the abdominal viscera. When we look at the parietal peritoneum where it covers the deep opening of the inguinal canal, or the deep femoral ring, we notice a slight indentation or depression, corresponding to these apertures ; digital fossæ of the peritoneum, as they are termed anatomically, from the resemblance of the depression to a slight indentation caused by the tip of the finger. When a hernia begins in either of the situations indicated, the pressure of the descending protrusion impinges on this shallow pouch, which gradually yields before it so as to form its investing covering or sac, and so in other forms of hernia with slight modifications. If you have followed my description of the formation of the sac from the parietal peritoneum, and recollect the relations of the visceral peritoneum, you will easily understand that the exceptional cases in which the protruded viscera have no peritoneal sac are rare, and almost limited to hernia of the iliac aspect of a portion of the caput cœcum coli where that viscus is not invested by the serous membrane. It does not follow, however, that the sac is absent in all cases where the caput cœcum coli forms the protrusion. I have operated on cases of both inguinal and femoral hernia containing the caput cœcum ; in all of them the peritoneal sac was present as usual, and opened, though in reducing the intestine its extra-peritoneal surface came into view. I apprehend that the manner in which the cœcum descends makes the difference. If it be pushed down, so turned on itself as to present its iliac or extra-peritoneal aspect, then the sac will be wanting ; but in my own cases I have never met with this condition. Congenital hernia is

sometimes mentioned as another example, but not correctly, for in it, that continuation of the general peritoneum forming the tunica vaginalis is the sac of the protrusion. The serous sac projected before a hernia is at first loosely connected to the surrounding textures, and its contents are free and unadherent. In old herniæ, however, the sac is generally more or less adherent by its posterior aspect, and very frequently closely adherent to the parts more immediately covering it. In small femoral herniæ we often find the fascial coverings, the glands, and the sac, all inseparably blended.

Perhaps the most important conditions of the sac are those structural changes which take place in it, and the adventitious connections formed between it and its contents. The portion of peritoneum forming the sac is liable to alteration in consequence of long-continued irritation; abnormal nutrition and inflammatory action, resulting in plastic deposit, thickening, and adhesions of the visceral contents to the sac. These adhesions may be either short and close, or long and filamentous, and of course interfere more or less with the functions of the viscera and the reducibility of the hernia. The whole sac may be enormously thickened and altered in appearance and structure, so as to lose all semblance of serous membrane as you may observe in the sac of an old scrotal hernia. Generally the body and fundus of the sac retain their natural appearance, or are but little altered; whilst the neck, or those parts which are subjected to constriction and pressure by the resisting structures of the apertures or canals through which the hernia is protruded, become thickened, condensed, permanently narrowed, and resistant. It is owing to this alteration in structure that the neck of the sac is so frequently the seat of constriction in hernia. In the same changes we find an explanation of constrictions at different parts of the sac—termed by French writers “sacs aux collets.” A protrusion has existed of a small size for some time, probably a truss has been worn, and the neck of the sac has become contracted and thickened; a larger protrusion pushes down before it the old sac

with its constricted neck, and this may give rise to special difficulties in operating should the hernia become strangulated. (See case of Peter B. in Clinical Cases.) When the sac is thin, the continuous pressure of its contents seems to efface it at some parts. I have seen two instances of this in old ventral herniæ, where the omentum was adherent to the subcutaneous fat, whilst the sac was perfect at all other points. This change, however, must be exceedingly rare, and I have never met with it in any form of hernia but the ventral.

The coverings of a hernial protrusion vary according to the part at which the protrusion occurs; but there is one covering which requires to be specially noticed—namely, that layer of condensed fibro-cellular tissue termed the fascia propria of a hernia. This, the immediately investing covering of the sac, is derived from the margins of the deep opening through which the hernia has protruded. The deep ring or aperture is in some fascial or aponeurotic structure, and the margins of the opening are not defined and abrupt, but are gradually prolonged downwards in a funnel form. Thus, for example, in oblique inguinal hernia, the margins of the deep ring in the fascia transversalis are gradually prolonged on the spermatic cord; and when the hernia occurs, the sac and its contents are insinuated beneath this layer in front of the cord, and hence it receives the title of the fascia propria of oblique inguinal hernia. Now, this layer of thin condensed fibro-cellular tissue, from whatever source derived, lies in close contact with the sac, and is moulded to the form of the protrusion which it invests. Like the sac itself, this fascia is subject to pressure, and gradually becomes thickened and condensed; portions of its deep surface, or of the fine extra-peritoneal cellular tissue often adhere to or closely embrace the neck of the sac, so as to form a constriction which may appear to be in the structure of the sac itself; and yet, by carefully dividing this condensed tissue, the constriction may be relieved and the protrusion returned without opening the sac; and it is therefore important to keep this in mind in reference to the extra-peritoneal operation for

strangulated hernia. Another thing to recollect is, that during an operation, this texture in cases of strangulated hernia, especially in femoral hernia, is fine, smooth, and not unlike the sac itself when closely applied over the swelling. You will, however, generally be able to satisfy yourself of its real nature by observing that it is prolonged indefinitely upwards on the swelling, owing to its continuity with the margins of the aperture. Whereas, when the sac is fairly exposed, the sharp defined margins of the aperture can be felt, though tightly constricting the protrusion.

The contents of the hernial sac may consist either of intestine alone, constituting what is termed enterocele, or of omentum only—epiplocele, or of both intestine and omentum—enteroepiplocele. The portions of the hollow viscera which may form the contents of the sac are various. Different parts of the colon or of the small intestine, and even the urinary bladder, have been found in hernial tumours. The portions of the intestine, however, most frequently met with are the ileum, occasionally the lower part of the jejunum, of the small intestine and the caput cœcum, or part of the sigmoid flexure of the colon in the case of the large intestine. The presence of omentum in the sac will modify both the physical and general diagnostics in reducible hernia, and will to some extent protect the intestine in cases of strangulated hernia, by diminishing the direct effects of the constriction on the intestine.

The diagnostic symptoms of hernia, in reference to other abdominal swellings, will be better discussed when speaking of the special herniæ. At present I shall merely indicate the absolute diagnostics in a case of simple reducible hernia. These may be described in general terms as consisting of a colourless elastic swelling, more or less distinct, at some part of the abdominal parietes, which has either appeared gradually, or been first noticed after some sudden effort. When the hand or finger is applied lightly over the swelling, and the patient is desired to cough, a distinct and direct impulse is communicated to the tumour, and probably an increase in its bulk takes place. On

laying the patient in the recumbent posture, the protruded parts generally return spontaneously into the abdomen, or the slightest pressure effects their reduction. If, after reduction of the swelling, the finger be passed upwards, the aperture through which the protrusion had descended will be felt; and if the finger be kept there, and the patient desired to resume the erect position, though impulse will be felt against the finger, the protrusion will be retained. On removing the finger, it will again descend. If the protrusion is composed of intestine, the return of the gut is attended with a peculiar gurgling sound. When the protrusion is omental, the swelling is not elastic, as in the case of intestine; it has a doughy feeling, the impulse or coughing is less distinct, percussion over the swelling is dull, and the reduction of the mass is not so readily accomplished as in the case of protruded intestine—the last portion requiring the same amount of manipulation to return it as the mass, and there is no gurgling sound as in the case of the intestinal protrusion. The clearness or dulness on percussion cannot be altogether trusted to, for in many cases of hernia the intestines are distended with fæces, solid or fluid, with little or no gaseous contents, and then percussion gives a dull sound.

The general symptoms present in a reducible hernia are not very marked. In some instances, when the protrusion first comes down, the patient feels sick, has griping pains in the abdomen and in the swelling. In cases of large omental protrusion there is usually a peculiar dragging sensation at the stomach, accompanied with nausea, and even slight vomiting, although there may be no constriction. In many cases of reducible hernia the patients feel so little uneasiness or pain that they too often overlook or under-estimate the serious character of the swelling, and satisfy themselves with returning it when uneasy, without even consulting a medical practitioner, or wearing a truss.

We now proceed to consider the causes which lead to the protrusion. These are divided into predisposing and exciting. The predisposition to hernia consists in any defect, either

congenital or acquired, in the abdominal parietes, which renders them less able to resist impulses which project the viscera against the weakened parts, and are similar, or rather the same, conditions I have already mentioned when describing the descent of a hernia. The exciting causes are chiefly due to the action of the abdominal muscles upon the contained viscera, forcing them towards the weak points in the parietes. This may occur under different circumstances—as, for example, from some sudden and violent effort; or as the result of frequent though less violent muscular efforts continued during a long period of time, as in certain chronic diseases, such as stricture, or enlarged prostate, when the abdominal muscles are called into action to assist the muscular coats of the bladder to overcome the obstruction; or in cases of chronic bronchitis, where the diaphragm and other abdominal muscles are called into action by the constant efforts in coughing. In either the sudden or more chronic form, if you recollect the elastic and mobile nature of the floating viscera, and consider the effect produced on them when pressed on from above and below, by the opposing forces of the diaphragm and levator ani, and from before and laterally by the recti, oblique, and transversales muscles, you will understand how the elastic mass so compressed tends to escape towards the least resisting points of the parietes, and to be protruded, either suddenly or gradually, at one or other of the weak points, according to circumstances.

In regard to the part at which the protrusion may take place, that will depend partly on some predisposing weakness in structure, as already explained; partly on the shape of the abdomen and pelvis; and partly on the form of the diaphragm, as tending to cause the force to impinge upon certain points rather than others. The late Mr. Vincent, in his work on *Surgical Practice*, explains this effect produced by the diaphragm by reference to its figure and the curves of its muscular fibres. “The figure of the diaphragm is that of an arched dome; but having a tendinous expansion in the middle, it is divided into two arches of muscular fibres. Now it is clear that if a muscular fibre

take a curved form, every point in the curve will act in the direction of the versed sine to that point, or what comes to the same thing, to the perpendicular of the tangent of the point. If the curves of the diaphragm were those of a sphere, these perpendiculars would all concentrate in one point; but this not being the case, the perpendiculars will be directed more copiously on some directions than on others—that is, the action of the muscle will be transmitted with greater force to some parts of the boundaries of the abdomen than to others, and thus determine the seat of hernia. If the chest be narrow the direction of the accumulated impulses may fall low, as well as if the distance from the diaphragm to the pelvis be but little, and so an increased impulse may be directed to the femoral ring, accounting for this seat of hernia in females. It is by no means uncommon to see an immense bulging above Poupart's ligament. The aponeurosis of the external oblique appears to be extenuated in these cases, and to yield prodigiously, so as to put on the appearance of a ventral rupture, the part being powerfully forced out on the patient's coughing. This is clearly the effect of the action of the diaphragm, by which the accumulated forces are directed to this spot."

We come now to the classification of herniæ, under the two heads of Reducible and Irreducible. These terms scarcely require any explanation. By the former we mean a hernia which can be reduced or returned into the abdominal cavity by gentle manipulation and attention to position, or which even returns spontaneously when the patient is placed in the recumbent posture. The objective and general symptoms of reducible hernia I have already described when speaking of the diagnosis of hernia, and I need not repeat them, but merely advert to its *Treatment*, which consists in the reduction and retention of the protrusion. Reduction is accomplished by placing the patient recumbent, with the shoulders slightly raised, and the lower limbs flexed on the pelvis, so as to relax the abdominal muscles; whilst, to prevent the undue action of the diaphragm, or straining, the patient is desired to keep his

mouth open. Then, whilst with one hand the surgeon presses the swelling from below upwards, he, with the fingers of his other hand, regulates the direction of the pressure at the neck of the swelling; prevents the protrusion from overlapping the margins of the opening and being pressed against them; and guides it backwards into the cavity. In many cases the protrusion recedes the moment the patient lies down.

Reduction having been accomplished, we then take measures to retain the viscera within the abdominal cavity. This is effected by means of pressure accurately applied over the aperture through which the hernia had descended. As such pressure requires to be maintained, it can only be done effectually by means of special apparatus termed trusses; but, in the first instance, until a truss be fitted, we may use a compress, supported by a broad spica bandage, to prevent the protrusion returning.

The proper application of a truss, and the form of truss best adapted for each case, are very important considerations, and the surgeon should be thoroughly conversant with the different forms of trusses and the principles on which they should be fitted, and also be able to take the proper measurements, and give general directions when the apparatus has to be obtained from a distance. It is impossible to do more than throw out some hints as to these points. The form of truss to be used will depend on the special kind of hernia, and the conditions present in different patients. In many cases the ordinary spring truss answers sufficiently well, if properly fitted and adjusted, and in some instances it is more effective than any other, whilst its price renders it more within the means of the poorer classes, in whom hernia is very common. But it has some disadvantages. It is liable to shift, owing to the movements of the patient; or, if the spring is sufficiently strong to prevent that, the pressure exerted by it cannot be easily borne. If it is selected for a case of inguinal hernia, care should be taken that the pad, whilst sufficiently large to diffuse the pressure, should not be so long as to rest on the spine of the pubis, as that tends

to prevent the truss pressing on the position of the deep ring and canal, where the compression is chiefly wanted. Pressure over the external ring merely prevents the rupture passing into the scrotum. The form of truss I prefer in general is what is termed "the opposite-sided truss," or "Salmon and Ody's truss." In this apparatus the spring passes from the centre of the back of the patient round the side opposite to that on which the hernia is situated, so that the pressure of the head is made obliquely from below upwards, so as to counteract directly the line in which the impulse of the descending protrusion is greatest. This form of truss is usually fitted with a ball-and-socket joint at the junction of the spring with the head or compress of the truss. Thus the apparatus is not displaced by the movements of the body, and the spring does not require to be so strong as in the common truss. At the same time, the pressure thus exerted is chiefly at one point, viz. the centre of the compress, and the hernia is apt to tilt up and escape from under the margins of the compress. To prevent this, and to maintain the direction of the force, I very generally use a back lever-spring added to the head. To some extent this interferes with the action of the ball-and-socket joint, but the accuracy with which the pressure is adapted more than compensates for that. In cases of femoral hernia the opposite-sided truss is decidedly preferable to any other, but the head should be formed to fit the triangular hollow of the groin, and its surface so shaped as to project deeply under the falciform edge as it were. The form of the head of Eagland's spiral truss, fitted to the opposite side spring, and secured by the back-lever pressure, answers very well in most cases. In some patients I have found the use of a small piece of soft sponge, applied over the femoral ring, and supported by the truss, of service where great difficulty was experienced in retaining femoral rupture.

— The following measurements should enable the instrument-maker to furnish the proper size. As an error of an inch may alter the whole proportion of the truss, it is necessary to give the full circumference of the body. Place the end of the

measuring-tape over the lower aperture, pass it slopingly upwards to about two inches below the crest of the ilium, across the back to the same point on the opposite side, and from that, sloping down again, to the opening. The measure in inches will give the size of the truss required. State the kind of hernia, and the side on which it is situated.

Whilst in adults afflicted with hernia the use of the truss can only be considered as a palliative, in children a carefully-applied truss, worn continuously, very generally effects a radical cure, by retaining the protrusion and compressing the canal through which it had descended; for, as the abdominal cavity enlarges, and its parietes are developed, the obliquity of the canal increases, so that the tendency to hernia is checked by the altered relations of the openings, whilst at the same time the textures are condensed by the continued pressure. In applying trusses in children, the pads or compresses should be of a flattened form, and not conical, for the latter form has the tendency to keep open the aperture and prevent permanent closure. This error is often committed in fitting trusses for umbilical hernia in infants, in which it is not uncommon to find the truss fitted with a conical or button-shaped pad, with the view of pressing into the aperture through which the rupture emerges. This may, no doubt, directly prevent the escape of the protrusion, but it also effectually maintains the aperture patent, and so prevents a radical cure.

Operations for effecting the radical cure of hernia, though connected with the treatment of reducible herniæ, will be better understood after considering the special herniæ, and the operative procedure in strangulated herniæ.

LECTURE CXI.

Irreducible Hernia—Causes which lead to the Chronic Condition—General Symptoms and Treatment—Acute Incarceration and Strangulation—Explanation of the Mechanical Causes leading to Constriction—Pathological Changes, and the Symptoms which attend them—Taxis : Principles and Methods to be followed in using it—Cautions regarding it—Dangers of Delay when the Taxis fails, or in waiting for urgent Symptoms to warrant the Operation—Causes of Death in twenty-six Fatal Cases.

IRREDUCIBLE HERNIÆ require to be subdivided according to the causes which oppose their reduction. Thus, a hernia may be irreducible owing to adhesions between the protruded portion of bowel or omentum and the hernial sac, which prevent the contents of the sac being returned into the abdomen. In such cases the changes have probably taken place slowly ; and although the protrusion is so far fixed as to prevent its reduction, it is seldom so largely adherent as to prevent the portion of intestine being affected by the peristaltic motion of the bowels ; and so its function, though perhaps somewhat impeded, is not interrupted, nor indeed materially affected. The patient may suffer occasionally from irritation in the hernia, flatulent distension and sluggish action of the bowels, but in general there are no marked symptoms connected with this state ; of course the condition of the patient is always extremely hazardous, as he is liable to inflammation, or strangulation of the protrusion being induced by various causes, such as external injuries or disorder of his digestive organs.

Secondly, a hernia may be irreducible from some alteration in form and increased deposit of fat in a portion of protruded omentum which has been left unreduced for some time, and has become so altered in form or bulk as to be no longer capable of being returned through the opening by which it had descended. In this case, if the patient applies for surgical aid

before adhesions take place, reduction may be gradually accomplished by using means for reducing the fatty textures, such as low diet, and perfect rest in the recumbent position, combined with cold and graduated pressure over the hernia. I have in several cases succeeded in returning such omental herniæ, sometimes after this treatment had been prolonged for three or four weeks, and in some cases after a shorter probation.

Thirdly, a hernia may be irreducible owing to its great bulk, and the altered capacity of the abdominal cavity. In other words, the protruded viscera have been so long and gradually displaced from their original cavity that they have formed a sort of new abdomen for themselves, whilst the abdominal cavity has accommodated itself to the remaining contents, and its parietes have contracted so as to diminish its capacity, and render it incapable of receiving its former contents. This condition is sometimes seen in large ventral, scrotal, and even, though rarely, in femoral herniæ. The general symptoms induced by this state of matters are chiefly those of flatulent distension, and occasional attacks of pain in the hernia from irritation of the bowels; but the condition has occurred so gradually that the patients have almost become habituated to occasional attacks, and seem to suffer little and think less about the hernia, until something leads to the more urgent symptoms of threatened strangulation. It is of great importance, however, that the surgeon should bear in mind the altered relations and capacity of the protruded viscera and the abdominal cavity, in reference to operations when required in such cases; for were he to make a very free incision, so as to lay open a large extent of the sac, his position might be very embarrassing. All he requires to do is to divide the constriction at the neck of the protrusion, and return as much as he can of the contents, so as to relieve strangulation: he cannot expect to be able to return the whole when the abdomen is so altered in capacity in relation to the protrusion. In the general treatment of all irreducible herniæ, the patient should be directed to wear a hollow truss to protect the hernia, and prevent further protrusion occurring, and gradually to repress the existing protrusion.

The patient should also be cautioned to take special care to regulate the action of the bowels, and avoid all sources of irritation of the digestive organs.

The foregoing examples of irreducible herniæ are not necessarily attended with any immediate dangers, although all of them render the life of the patient precarious. But when a hernia becomes irreducible, from acute incarceration or strangulation, the case is very different. Then the danger is imminent, and the symptoms soon denote the urgency of the case. Such acute incarceration and strangulation depend on constriction of the protrusion, leading at first to interrupted function in the protruded intestine, followed by peritonitis, and more or less rapidly by mortification of the protruded parts, the result of complete strangulation. The term, INCARCERATION in hernia, is used by some authors to include herniæ imprisoned by adhesions or altered bulk from chronic changes; but I think it better to confine it to denote the early stage of acute constriction, before complete strangulation takes place.

There is, perhaps, no disease in which it is more necessary for the surgeon to have clear ideas as to the exact conditions with which he has to deal, than in acutely-incarcerated or strangulated hernia. The very term constriction, though proper when correctly understood, is apt to mislead, by giving the idea that some active contraction of the apertures or structure, through which the protrusion emerges, has taken place. We have seen that the openings through which herniæ pass, are formed in fascial or aponeurotic structures. It is at these apertures, or at the contracted portion of the sac, or in the resistant condensed fibro-cellular substance, external to and around the neck of the sac, that the cause of constriction exists. The muscular textures crossing over the protrusion may compress it and oppose its reduction to some degree, and favour congestion in it; but they can never absolutely constrict it; and, besides, by various methods, we can obviate muscular contraction; but, I repeat, it is in the aponeurotic and condensed fibro-cellular structures that the resistant cause of constriction is to be found. In one instance,

indeed, I found the cause of constriction in a vessel circling round the neck of the protruded intestine ; but the case is unique, and not to be included when considering the general causes of constriction.

Holding the views I have expressed, we get rid of the idea of contraction of muscles constricting the hernia, and look on such muscles as merely complicating the condition of incarceration or strangulation ; and I now proceed to point out how the protrusion becomes constricted. In the majority of cases of hernia which become strangulated, the protrusion has existed for some time previously, often for many years, and the openings through which the hernia descends are dilated, not contracted ; and this condition, at first sight, seems difficult to reconcile with the idea of constriction. But the dilatation just amounts to this, that the thinner and less resisting margins of the apertures in the fascial textures have yielded to the gradual eccentric pressure of the hernial protrusion. These thin margins, so forced back, condense and render the denser structures more resistant, so that they oppose further dilatation—the circle of the opening offers passive resistance. If under these circumstances a fresh portion of intestine or omentum descends, and if the protruded gut becomes distended with fæces or flatus, or the omentum becomes congested, there arises an altered proportion between the protrusion and the opening or canal through which it descended. The neck of the protrusion is distended and pressed against the resistant margins, and is indented by them. Then irritation of the gut and congestion from interrupted venous circulation follow, till increased congestion, swelling, and distension, terminate in complete strangulation. To make my meaning clear to a demonstration, I take this unyielding metallic ring, and I pass through it a loop of intestine. In its partially-distended state it can be easily pushed back through the ring, but I distend the gut by inflation. As I do so, you notice the altered proportion of the protruded part of the intestine. Still, by a little management, the gut can be reduced, but now I distend it fully. You see how the gut is indented

by the resisting ring, and swells out over its margins, and can no longer be pushed back through it. This explains the nature of mechanical constriction in strangulated hernia. It is entirely passive as regards the hernial apertures, and depends on various conditions leading to distension or swelling of the contents of the hernial sac ; and the thickened neck of the sack, as I have stated formerly, is very frequently the cause of this passive constriction.

The pathological changes and symptoms which follow the early stage of acute incarceration, leading to strangulation, are, first, irritation and swelling of the protruded gut, and this is usually attended with some nausea and griping pains in the abdomen, and tenderness in the hernial protrusion. The peristaltic movements of the gut are interfered with, and the return of venous blood is prevented, so that congestion ensues, gases become evolved in the gut ; thus the hernia becomes more and more tense and distended, and more and more pressed out towards the resisting edges, so that these appear to cut into the hernia. It is important to remember these conditions while applying taxis. At this stage of incarceration certain symptoms are produced. The patient complains of pain in the part, from the gut coming in contact with the sharp edge of the fibrous texture. Some irritation is also produced in the part above the constriction. There is pain from the umbilicus towards the hernial protrusion, a feeling of nausea is set up, and the patient vomits, especially if the hernia has come down suddenly. Sometimes the irritation is communicated to the part of the bowel below the hernia, and causes an attack of diarrhoea. The pain and distension become greater, the intestine becomes distended, so that the natural peristaltic movements of the bowel are arrested or inverted. The pain and tension in the tumour increase ; the abdomen is tense, tender, and tympanitic, and the vomiting becomes more frequent. The pulse at this time is quick, the skin is hot and feverish, the tongue moist and loaded, and there is generally headache. In old people, or in chronic cases, the symptoms are not always so urgent. The vomiting

may undergo marked remissions ; it may be present at first, and then become less violent, so that we might think the patient somewhat better ; but this often depends on the stomach being empty, and vomiting returns if liquid or solid food be taken.

Then the symptoms become more serious. The tumour becomes less painful, perhaps, but the integuments covering it become of a dusky red hue ; the abdomen becomes more tympanitic ; the pulse small and irregular ; and the vomiting changes in character. At first the matter vomited may be greenish in colour, but ultimately the contents of the gut are vomited, and—from the arrested peristaltic movements—*æaculent* vomiting takes place. The upper portion of the bowel is obstructed from the first.

Occasionally, when the portion of intestine which has been strangulated is very high up, we may have the appearance of bilious stools even when in reality strangulation is most complete ; but this is not common. When the bowels have been emptied at first, we find that nothing more passes, for nothing can pass from above the constriction, unless in cases where only a portion of the canal of the gut is constricted. The skin gets cold and clammy, the features become sharp ; there is constant hiccup, and, unless relieved by operation, the patient dies from gangrene of the intestine, with all the symptoms of collapse. Before this takes place, however, the local symptoms are usually well marked. *Emphysema* takes place under the skin, the tension becomes diminished, and the tumour feels doughy or *emphysematous*. The bowel gives way into the sac, and unhealthy sero-purulent matter forms in the subcutaneous tissue over the hernia. These are the typical symptoms of a hernia passing from the state of acute incarceration to strangulation. We may also have all the violent and

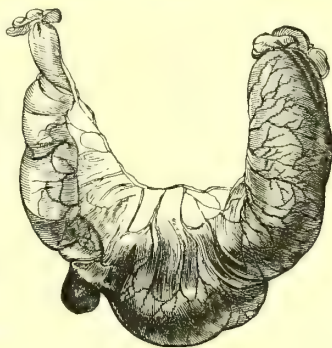


Fig. 35.

dangerous symptoms present from a portion of omentum becoming strangulated, though in such cases we may have the free movements of the bowels, as the bowel itself is not constricted. In some instances only a part of the intestine is nipped in the constriction, and then also the bowels may continue to act. (Fig. 35.)

In old people the symptoms go on more slowly, and insidiously. Often the pulse does not rise, and there is simply tension of the abdomen. The bowel is sometimes rapidly constricted, and the gangrene is confined to the portion protruded. Long before complete strangulation the constriction may lead to peritonitis, with pain and tympanitic tension of the abdomen, and pain on pressure. The peritonitis generally commences at the constricted portion, spreads along the peritoneal surface of the bowel, and then attacks the parietal peritoneum. This is a most dangerous condition, almost as much so as gangrene itself. Peritonitis is sometimes supposed to supervene in consequence of the operation; but I never saw a case of peritonitis in hernia where the peritonitis did not exist prior to the operation.

We sometimes find a portion of the bowel which has been protruded retaining the indentation caused by the stricture, even after the constriction has been removed, thus causing intestinal obstruction, either complete or partial. Occasionally the portion which has been constricted gives way some days after the operation, and then the symptoms are those of acute peritonitis rapidly supervening. This arises from ulceration of the mucous membrane of the bowel, the peritoneal coat only giving way at the last, and so perforation takes place, either by a large rent or numerous minute apertures. (Plate li. Figs. 2 and 3.) I have also known this to occur when the hernia had been reduced by taxis—in one case eight days after reduction.

It is most important, as I have already said, that you should fully understand the methods by which, and the principles on which, the surgeon interferes in cases of hernia, because promptitude in treatment is essential to a successful result.

In a case of incarcerated or strangulated hernia, where it cannot be easily reduced, the surgeon must have recourse to other measures ; and the first of these is the Taxis. Although, in the ordinary reduction, the pressure by which the hernia is returned may be called taxis, yet by taxis we mean reduction by manipulation, where the hernia is not, as usual, reducible by the patient, and where a certain amount of incarceration has occurred. The first thing to do is to ascertain whether the difficulty in the reduction does not depend on the protrusion having been twisted upon itself, as very often happens in femoral hernia, where, from the way in which the hernia descends under the falciform edge, the body bends upon the neck, and tends to pass towards the abdomen. In such cases, therefore, we cannot press back the tumour directly, for then the pressure would not be in the axis of the opening through which the tumour has passed. Hence we must always attend to the position of the tumour, and its relations to the canal or opening through which it has passed.

Again, the tumour may yield to a certain extent in relation to the canal, but if it be very bulky, and if we press directly upwards or backwards, we press the mass of distended intestine and omentum over the margins of the opening, and thus create a difficulty. Hence attention to the position of the tumour, and the mode of dealing with the bulk which is protruded, are very important in attempting reduction. Often no difficulty occurs in reducing the bowel, if these little points be attended to. The difficulty, however, more generally occurs from a certain amount of incarceration and constriction being present, and a loss of proportion between the protruded parts and the opening through which they originally passed. In reducing such a hernia in the early stage, when the patient begins to feel a little nausea or vomiting and pain in the tumour and abdomen, but without any great general distension of the abdomen, and where there is no reason to suppose there is any absolute strangulation, the first thing to do is to relax the parts, and place the patient in as favourable a

position as possible for the taxis. Muscular fibres never form a complete constriction in hernia, but they may give rise to some congestion by pressing on the tumour, and hence we relax all muscular fibres as far as possible by placing the patient in certain positions ; so also with all tense fascial margins. Thus, in inguinal hernia, we generally bend the body forwards and raise the lower limbs, so as to relax the anterior abdominal muscles, and get over certain obstacles to the reduction. In femoral hernia, again, we turn the thigh inwards, and flex it slightly upon the pelvis, so as to relax the falciform edge of the fascia. These are examples of the position in which the patient should be placed for the taxis. Formerly, the warm bath, tobacco enemata, bleeding, and simple distending enemata, were used as adjuvants to the taxis. Now, the only thing done is to give an enema to clear out the lower part of the bowel, and also to excite the peristaltic action of the intestine above, thereby giving a chance of the hernia being drawn backwards into the abdomen. The use of tobacco enemata and bleeding are quite unnecessary since the introduction of chloroform, which is both a safer and more effectual relaxant of the muscles.

If it be true, as I believe, that the real constriction in hernia is always formed by aponeurotic or fascial texture, then we cannot expect very much good from relaxation of muscles in tightly-incarcerated herniæ ; but we prevent the violent action of the diaphragm and of the abdominal muscles, while we also prevent the patient's straining against us. The enema should be given in very large quantity, to distend the lower portion of the intestines thoroughly, and excite them to peristaltic action. We should apply cold to the tumour, either by means of the ether spray, or by ether dropped on the part, which should be fanned, or what is still better, place some ice in a bag over the tumour for a short time. Cold should only be used in cases of recent hernia, and should not be continued long, and never when there is any suspicion of gangrene. The cold is beneficial in two ways ; generally there have been attempts made both by the patient and by the surgeon to reduce the gut, and these give rise to a

great deal of irritation and tenderness in the part, independently of the hernial symptoms, and the hernia itself is engorged from venous congestion. The cold relieves this local irritation and congestion, and causes contraction of the vessels. It also diminishes the distension of the gut itself, and by condensing the gaseous contents, lessens the bulk of the protruded mass. These are the means which I would advise you to use as auxiliaries to the taxis.

The patient should be put thoroughly under chloroform before the taxis is attempted. If the bowel is not so tightly constricted as to prevent its being returned by taxis, we will be able to reduce the hernia under these circumstances if the taxis be properly applied. In a case of femoral hernia, for example, we bring the hernia down to the axis of the canal through which it has passed; and now we must not press upwards, as that would only press the hernia upon the margins of the opening, but rather draw a little portion down, and then gradually try to pass the hernia back, bit by bit, into the abdomen. When once a small portion is got through the opening, the rest of the gut soon follows, with a peculiar gurgling sound. If we find that the taxis properly applied fails to reduce the hernia, then we should lose no time in operating, for I believe that any further persistent attempts at reduction by the taxis, owing to the manipulation, delay, and the risk of peritonitis, are much more dangerous than the operation itself. In many cases, if the hernia has only been down for twenty-four or thirty-six hours, and if the symptoms are not very marked, we can return the bowel by the extra-peritoneal operation, *i.e.* without dividing the sac of the hernia at all. Thus we only cut through skin and fascia, and this cannot cause any great risk; but in the taxis, we cannot tell how the part is constricted—we may be pressing the intestine against the sharp margins of the ring, and so cause very serious lesion. Often on operating we find that the taxis has done harm. We must of course give the taxis a fair trial, but do not put off too long with it; there is no risk, I hold, in the operation itself, whether extra-peritoneal or by opening the peritoneum, if done early, and before changes have taken

place. The causes of death after operation are invariably due to changes taking place in the sac, or hernial protrusion prior to the operation.

I feel satisfied that in cases of incarcerated hernia the fatal results depend rather on the state of the parts prior to the operation, and on delay in operating, than on the operation itself, which involves scarcely any risk to life; and it should therefore be performed without undue delay, when it will probably be necessary at last. We are sometimes advised to wait until urgent symptoms come on, but this is very wrong. What is the use of waiting for the urgent symptoms? The very accession of these shows that the bowel has undergone changes which would render the operation much less likely to be of use. Another point often insisted on is, that in small herniæ, such as the femoral, we must be quite sure we have to deal with a hernia. We are told sometimes it may be a gland, for there is no impulse in the tumour; but in a very tightly-strangulated hernia we cannot expect impulse, and this is merely a greater reason for operating, as the part is so tightly constricted. I never yet felt any impulse in the tumour, when the bowel was thoroughly strangulated; and the want of impulse is a sign that the bowel is completely and tightly strangulated. As regards the tumour being a gland, or a collection of matter, the diagnosis is to be found in the history and symptoms of the case. In doubtful cases, operate. If it be a gland or an abscess, an incision over the tumour will do no harm whatever; but if it should be a hernia, and if we delay the operation, waiting for urgent symptoms, we are risking the patient's life. I have repeatedly met with objections of the kind above alluded to, but I have always operated wherever there was the slightest doubt; and I have never yet operated without finding a hernia present, and this experience, conjoined with the great general principle, justifies me in strongly advising the operation.

Several years since I looked over the results of 127 cases of hernia in which I had operated, and in these there were 26 deaths: in 17 out of the fatal cases the gut was

distinctly gangrenous, and therefore, though the operation was the only chance of saving the patient's life, the state of the intestine was such that a favourable result could hardly be expected. In 7 cases, peritonitis had commenced before the operation ; and of these, 4 were cases of congenital hernia, where peritonitis occurs rapidly. In one case, pyæmia proved fatal on the eighth day, but this case was a very complicated one. In one recent case, a fatal result occurred : here the operation was extra-peritoneal, and the hernia was very large and bulky, and had come down rather rapidly, while the patient was at his work. The man made violent efforts at the time to reduce the hernia, while afterwards attempts were also made, but without success. In this case, the hernia had only been down for twelve hours. When I operated, I divided the integument and the fascia down to the deep ring, and then, by dividing the textures external to the neck of the sac, I was able to reduce the hernia with great ease. After a time, the patient began to pass bloody stools, showing that hæmorrhage from the interior of the gut had taken place, evidently in consequence of the efforts the man had made to reduce the hernia at first. I believe, that if cold had been applied to the tumour, and the taxis properly employed at first, the hernia might have been reduced without any operation. The real cause of the fatal result was evidently the mischief produced by the violent and ill-directed efforts made by the patient to reduce the hernia, when it came down.

LECTURE CXII.

Treatment of Hernia by Operation—Results—The Extra-Peritoneal Operation—
The Ordinary Operation—After-Treatment : Local and General.

THE OPERATION for HERNIA consists essentially in the division of the constriction of the hernia ; but to reach this constriction we require to divide certain parts, which differ in the special herniæ. The great object is to expose the constricted part, and to divide it thoroughly and completely. To do this in all cases of hernia, whether large or small, the incision should be made so as to give us plenty of room over the part corresponding to the neck of the sac, or where we expect to meet with the constriction. In inguinal hernia, there is no use making an incision down the whole length of the scrotum ; in fact, this very often misleads. The incision should be made where we feel the neck of the hernia, and should extend above and beyond this so as to let us see the parts properly ; and for this, an incision two or three inches in length is quite sufficient. If we expose the parts too much, we are very apt to have a quantity of the intestine coming out of the incision. The incision should be no longer in a large than in a small hernia. We should aim at exposing the part where the constriction exists, and then we see exactly what textures we require to divide, for these are different in different herniæ, though the principle of the operation is the same in all cases. The constriction may be in the aponeurosis through which the hernia has passed out ; or it may be in some condensed cellular tissue, external to the neck of the sac, for a few fibres will sometimes cause constriction ; or it may be, and very generally is, in the sac itself. The constriction in old-standing and in congenital herniæ is almost invariably owing to thickening in the neck of the sac itself. This thickening takes

place by deposition of lymph and condensed cellular texture from without, and the smooth surface of the peritoneum only becomes contracted towards the very last. In recent cases, by scraping rather than cutting on the constricted part, we can often readily reduce the hernia without opening the sac. This is called the extra-peritoneal method of operating.

The next thing to consider is the state of the bowel when exposed. If we have operated early and by the extra-peritoneal method, we do not see this; we simply return the contents of the sac into the abdomen, taking care not to push it up *en masse*. It is very important to remember this rule in small herniæ, for in them we might push the small knuckle of gut up within the abdominal parietes without relieving the stricture, and this is more apt to occur if the sac be not opened. To avoid this in the extra-peritoneal method, we must take care as to the mode of dividing the constriction. We see the constriction in the tightness existing round the swelling; we find the parts above and below distended, and when we scrape through the fibres causing the constriction, the indentation on the sac immediately becomes effaced, showing that the constriction is relieved, and that the contents of the upper portion of the bowel pass down to the portion in the sac. The protruded intestine can then be readily returned from the sac into the abdomen. We may then invaginate the sac, if it be small and loosely connected, and so get it out of the way of the pressure of the thick retaining pad. In inguinal hernia, however, we cannot generally do this.

When we require to examine the state of the bowel, we must open the sac. This is an important point in the question between the extra-peritoneal, and the ordinary operation in which the sac is opened. Why do we open the sac in any case when the bowel is to be returned? My answer to this is, that in many cases when I commence the operation I cannot be sure that the bowel is in a state to be returned. The extra-peritoneal operation is proper when the case is very recent, and when there is no reason to suspect any alteration in the structure of the bowel,

and when there can be no hesitation in returning the bowel. But if the hernia has been constricted for forty-eight hours, I would not feel justified in performing that operation, for in that time changes may have taken place in the bowel itself, and the very reduction of the affected bowel might prove fatal to the patient. The extreme advocates, however, of the extra-peritoneal method say that we try the taxis, and hence, say they, you would have been quite content to return the bowel by the taxis without seeing it, and why not after operation? But it is clear that if the taxis reduces the hernia, the parts have not been actually strangulated, while, if the taxis does not succeed, it shows that strangulation has occurred; and if some time has elapsed during which the hernia has been down, the condition of the bowel may be such as to render it unwarrantable to reduce it into the abdomen. A doubt as to the fitness of the bowel for return is thus raised, and when there is any doubt I prefer to open the hernial sac and see the state of its contents.

We often find, when operating for hernia, that the moment the bowel is brought into view, and the stricture divided, if we then try to push up the gut, we very often succeed readily enough, and often without any harm resulting; but this is not very safe, for we should see the state of the bowel at the constricted part. We must not judge by what we see protruded below the constriction, we want to see the part which has been subjected to the greatest pressure, and also to make sure that we have thoroughly divided the stricture. I therefore gently draw down a portion of the bowel from above, which brings into view the part which has been subjected to the constriction, and from this part I judge whether to return the bowel or not, for this part may show symptoms of incipient gangrene, and if it were returned the results would be fatal. We should therefore always examine the bowel in this way; and this also gets rid of the indentation of the gut, which sometimes remains for a length of time. It moreover shows us the state of the bowel above; and I think this is important, for I judge of the result of the case very much by the appearance of the bowel

above the constriction. If it be of the natural appearance of a pinkish-grey colour, and smooth, and glistening ; even though the constriction has been tight, I generally augur well of the case, for this shows there is no general peritonitis, or if there is any, it is only in a very slight form ; but if the bowel be granular and vascular, and covered by a sort of glistening fluid on the surface, even though the part of the bowel below be not much congested, then I consider the prognosis of the case to be unfavourable ; the patient will probably die of intense peritonitis, for it is already existing before the operation.

In some cases we find the condition of the bowel rather doubtful ; and in small herniæ this is very troublesome. We find a portion of the protruded gut dark, congested, and ecchymosed. I have even seen a portion of bowel quite black from ecchymosis caused by the taxis, and yet the patient recovered perfectly ; but if the bowel be granular, and has lost its smooth appearance, or is soft like wet paper, the case is very doubtful ; and then we generally find the constricted part deeply indented, and of a somewhat pale yellowish colour. If we see, moreover, that on the surface of the bowel there are points here and there of a greyish or white appearance, even though they are small, the risk is greater, for probably a slow form of gangrene is occurring, and this is showing itself by these points in the parts beyond the constriction. If the gangrenous or ash-coloured spots be minute and not numerous, there is a chance of the patient's recovering without opening the gut ; but if we find the gut perfectly gangrenous, and of a dark colour, we must not return the bowel under any circumstances. In such circumstances we are told to cut off the portion of gangrenous bowel, and allow the fæces to be evacuated through the wound after the stricture has been divided. Such is the general practice, and so I used to do ; but my own experience has altered my practice in this respect. Even when the bowel is distinctly gangrenous, I do not cut off the gangrenous portion of gut at once, for I have seen that in many cases in which this was done, the patient, instead of experiencing

any relief from the operation, died with intense suffering. When we cut off such a portion of bowel, and divide the constriction at the same time, as the patient is recumbent while a portion of the fluid fæculent matter passes externally, part of it also passes back into the abdomen along the external surface of the gut, and so more acute peritonitis is set up. I therefore divide the constriction freely, and draw down the gangrenous portion of the gut beyond the stricture, and leave it in the wound, merely covered by lint soaked in warm water. I give the patient an opiate after the operation, and then some hours afterwards I open the gut and cut off the gangrenous portion, so as to allow the fæces to escape. By that time lymph has been effused around the protruded gut, and the risk of fæculent fluid passing back into the abdomen is very much lessened. I have seen great benefit derived from this method in diminishing pain by obviating acute peritonitis, even though it may not lessen the great mortality after the operation when the bowel is gangrenous. When the state of the bowel is doubtful, which is most frequently seen in femoral hernia, the plan I have adopted for many years to prevent effusion taking place into the abdomen, is to draw the bowel down and examine it as usual, and then simply return it—not into the abdomen—but just within the ring, keeping the doubtful part of the gut opposite the wound, so that I can feel it readily; no dressings are applied on the wound beyond warm-water lint; the patient is placed in bed with the pelvis somewhat raised, so as not to allow the rest of the bowel to drag back the doubtful portion, but this is not very likely to occur, owing to the effusion of lymph which takes place.

In many of these cases it happens that perforation does take place afterwards; generally from the sixth to the eighth day after the operation. The patient is relieved from all the symptoms of strangulated hernia by the operation; opiates are given to check the action of the bowels at first, but in about a week a small quantity of thin fæculent or bilious matter is discharged from the wound, and this gradually becomes more

Fig 1



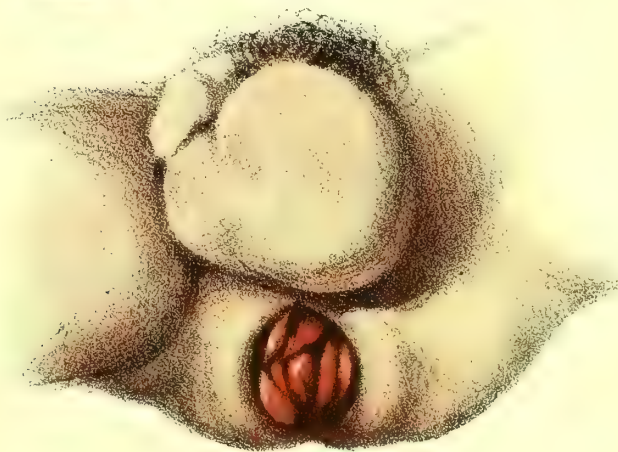
Fig 2



Fig 3



Fig 4





copious, showing that the bowel has given way. If effusion of fæculent matter takes place, a fistula is formed, and no harm is done, as the parts heal and become adherent to the part corresponding to the opening in the bowel. If the bowel does not give way, the patient is no worse than in ordinary cases. In a case at present in hospital, the symptoms had existed for some time before the woman was brought into the hospital ; the parts over the hernia were red and congested, and it looked like a gangrenous hernia ; on examining the bowel, I found it to present white points at one or two parts of the surface, and I therefore adopted the plan of treatment just described. In this case, the patient, instead of going on from bad to worse, as might have been expected—for peritonitis had set in before she was brought to the hospital—has gone on very well, and now the wound is healing ; all the bad symptoms have passed off, and no fistula has formed. This, and many similar instances, satisfy me that, in cases where the bowel is at all doubtful-looking, the above plan of treatment is the best we can adopt. In cases where the bowel is decidedly gangrenous, I repeat that we should not cut it off at once, but divide the constriction, and wait till lymph is effused before we remove the gangrenous part, so as to prevent the fæculent matter passing back into the cavity of the abdomen.

The after-treatment of cases of strangulated herniæ, in which the condition of the bowel is such that we are justified in returning it after division of the constriction, is comparatively simple. Still there are some points of importance to be attended to as regards the principles on which it should be conducted.

At one time the general practice of surgeons was to give a purgative soon after the operation, so as to obtain a free evacuation of the bowels, and satisfy themselves that the operation was successful, as it was termed—that is, to be sure that the constriction was relieved. The effect of this violent action excited in the intestinal canal often injuriously affected the portion which had been strangulated, and set up enteritis and peritonitis ; and in the present day most surgeons are agreed as to the propriety of

avoiding such stimulation of the intestine after operations for strangulated hernia. In my own practice, immediately after the operation, I give an opiate, to delay the peristaltic action as much as possible and keep the bowels quiet, so that the intestine may not be irritated by the passage of the feculent matter. The opiate also allays the vomiting and irritation which are present. After thirty-six or forty-eight hours, we may give an enema to stimulate the peristaltic action of the bowel. In general, however, if there has been any great distension of the intestine, the bowels will generally act after the operation without any purgative. When the bowels are long of acting, as sometimes happens in old people, we should give some gentle laxative. The local treatment is very simple. The wound is to be dressed like an ordinary wound, and a compress supported by a spica bandage is applied over the opening to prevent the hernia descending. The wound seldom heals entirely by the first intention, but the greater part of it heals pretty quickly ; and after four or five weeks we may fit on a truss.

In cases where, from the previous symptoms and from the appearance of the intestine, as seen during the operation, it is evident that peritonitis has set in, the use of calomel and opium in the proportion of half-a-grain of the latter to two grains of the former should be begun at once, and the dose repeated every four or six hours, till some slight effect is produced on the mouth ; or, in some cases, opium may be given alone at intervals with good effect. If the patient be young and robust, leeches may be applied over the abdomen. In all cases, the application of a blister over the epigastrium, or over the whole abdomen, with the exception of the part near the wound, is advisable, and it is much more generally applicable and productive of more benefit than leeches. Enemata may be used to relieve the tympanitic condition of the bowels ; but no active purgatives should be given. Under this treatment I have seen several severe cases of peritonitis recover ; but in general, the diseased action has existed and spread extensively before the performance of the operation, and then the case is very hopeless. The treatment of the large

masses of omentum sometimes found in operating for strangulated hernia, especially in old large herniæ, requires some consideration. In many instances, after division of the constriction and reduction of the intestine, we find that the omentum left in the sac is very bulky, and partially or largely adherent to the sac, or large portions of it are nodulated and altered in form and consistence.

The reduction of a very large mass of omentum, even supposing no adhesions or alteration in structure have occurred, is always attended with the risk of exciting peritonitis, owing to the manipulations required; for it does not glide back like the intestine. Every portion requires to be guided and pressed back, and when it has suffered from strangulation, its vessels are congested, and then portions of the serous texture are liable to be lacerated by the manipulations necessary to return it. In other cases, when adherent or when altered in structure, forming as it often does a large pedunculated mass, the difficulties and dangers are increased. Under these circumstances, the question arises whether there is least danger incurred by removing the protruded mass, or using efforts to reduce it. If the portion of omentum be not very large, inadherent, and presents a healthy appearance, the proper treatment is to enlarge the incision of the constriction freely, and gradually reduce the mass, keeping the sac intervening between the omentum and the fingers. If the protruded omentum be of moderate bulk, and only partially adherent to the sac, divide the adhesion, taking care to twist or tie a small vessel that may ooze, and then proceed as in the former case. In cases where the omentum is very bulky and loaded with fat, or consolidated and altered in form, so that the incision of the abdominal parietes would require to be very large to enable us to return it, and even then only with considerable manipulation and probable irritation or laceration, the safest plan is to remove it. The neck of the mass is firmly grasped by the assistant, and transfixed with a needle armed with a fine silk or catgut ligature, the loop of the ligature divided, and each portion of the neck of the

mass firmly constricted, and the protruded omentum cut off close below the ligatures, which are then cut short, and the upper portion of the omentum reduced. Or, the neck of the omental protrusion being firmly grasped, the surgeon cuts away the bulky portion, and ties each bleeding point separately. I have treated such cases very frequently in both ways, and cannot say I have ever seen any bad results fairly referable to the section, whether the ligatures were applied by tying the vessels individually, or simply by constricting the neck of the protrusion as described. If the omentum, even when not bulky, presents any doubtful appearance of commencing gangrene, there should be no hesitation as to its removal, as the fat with which it is loaded has but little vitality, and is not likely to recover when reduced.

The local after-treatment of gangrenous herniæ, in which a portion of the gut has been cut away, consists in applying a fold of lint soaked in warm water, and covered with gutta-percha tissue over the wound; favouring the escape of the fæculent discharge, and paying great attention to cleanliness. There is at first a fulness of the mucous surface of the intestine, causing it to project, so that it forms an obstacle to the passage of the fæces; and there is also a loss of tone in the intestines, so that they cannot propel their contents as usual; hence the surgeon often requires to introduce his finger, or inject some tepid water, to help the fæces to pass away. This distended and convoluted state of the bowel is one which is very common, and which is often fatal in peritonitis, even where there is no gangrene, from the obstruction it gives rise to. Supposing, however, the patient to go on well, we require to consider the question how the artificial anus which results is to be cured. The two portions of intestine connected to the mesentery at the root of the loop of the protrusion lie at first parallel to each other, and the contents of the bowel pass completely from the orifice of the upper portion through the opening. The lower part has a tendency to become contracted, for there is nothing passing through it. After a time, however, owing to the contraction

from the effusion of lymph and the healing process, we find that the two parallel portions of the bowel gradually tend to approach each other, and come to an angle as it were ; the orifices thus approach nearer the axis of the line of the gut, and what the surgeon has to do is to take advantage of this natural process, and assist it to a certain extent. After a time, as I have said, the portions of bowel tend to become more in a line, but still the passage of feces prevents closure of the intestine, and the septum will continue to act as a valve, and a feculent fistula will be established. Sometimes nature will cure the fistula, but the surgeon occasionally requires to use compressing forceps to efface the septum and establish the continuity of the canal of the bowel. The blades of the forceps are introduced separately into the two portions of the bowel, and they are very gradually closed upon the projecting septum, so as to compress it. If this be done too tightly at first, violent irritation may follow, and hence great care is required in watching the patient after the first application of the forceps. They are kept on for some time, and gradually the valvular projection of the septum is effaced, and the continuity of the bowel is re-established ; the feces pass along the track of the bowel, and the natural channel is restored, while the fistula gradually heals. In less extensive gangrene of the bowel, treated by the method I recommended when speaking of the slightly gangrenous or doubtful state of the gut, when a fistula does take place we do not require this treatment, for in such cases there is only one opening ; the continuity of the bowel is complete from the first ; the parts become adherent to the integument, and the opening contracts and heals up.

LECTURE CXIII.

Complications met with in cases of Hernia before and after Reduction—Illustrative Cases—Precautions in operating which they suggest—Special Herniæ, and their Treatment—Inguinal Herniæ: Direct and Oblique—Differential Diagnosis.

I HAVE now brought under your notice the usual pathological conditions in cases of hernia, and the general principles on which the treatment of these conditions should be conducted ; but before proceeding to the consideration of special herniæ, I must refer briefly to some complications, occasionally met with, which may render our diagnosis as to strangulation of the protrusion, and consequently our decision as to the line of practice to be adopted, more difficult. Some of the conditions which may cause doubt as to the nature of a swelling occupying the position of a hernia, such as hydrocele of the cord in inguinal, and enlarged glands in femoral hernia, I have already alluded to, and they will require to be noticed when speaking of special herniæ. At present I shall confine myself to noticing two conditions—1st, Cases of old irreducible hernia, in which symptoms usually indicative of strangulation occur. 2d, Cases in which symptoms of strangulation continue, after a hernia seems to have been fairly reduced by taxis.

The former condition is that in which there is most difficulty in deciding as to the symptoms depending on strangulation. One of the conditions which enables the surgeon to decide and act promptly, by operating early, in an ordinary case of strangulated hernia, is, that hitherto the rupture had always been reducible by taxis, but has become suddenly irreducible, and is accompanied by symptoms more or less urgent. This can only be accounted for by constriction of the protrusion ;

and the surgeon proceeds on that ground. In the class of cases I am now speaking of, this element, so important to correct diagnosis, is wanting. The protrusion has in these cases been irreducible probably for years, owing to adhesions, or some other cause ; and whilst the symptoms present may depend on strangulation from fresh accession to the protrusion, or from congestion and engorgement of the old protrusion, they may also depend upon mere irritation of the intestine or omentum contained in irreducible hernia, for the protruded parts are quite as liable as other portions of the viscera to be affected by various sources of irritation. The tumour is more tense than usual, tender to the touch, and there may be vomiting and constipation, and yet the hernia may not be strangulated ; and having been long irreducible and fixed there, you cannot hope to reduce it now.

I recollect many years ago being called to see an elderly woman, a servant, who was labouring under very urgent symptoms—vomiting, tension of the swelling (an old irreducible femoral hernia), and tenderness of the abdomen. Enemata and other means had been used before I saw her, and medicine given by the mouth, but without affecting the bowels. I tried gentle pressure to the swelling, after having applied ice for some time, in hopes that I might reduce any new descent which might have occurred, but without effect. I then advised her to submit to the operation, but she refused, and stated as her reason that she had formerly had a similar attack, and that Mr. Liston had insisted on operating, but she had refused, and got better. I ordered her an opiate to relieve the pain and vomiting, but told her friends to send for me if the symptoms continued, and left her with forebodings of a bad result. Next day, when I went to see her, I found her almost quite well, and then I was informed that there had been a party in her master's house, and that she had tasted a variety of articles, and so set up the irritation in the hernia. Still I consider I would have been fully warranted in operating under the circumstances in which I first saw her. In several very similar cases which I have met with, I have had to operate, and in all of them there was tight strangulation, so that, had I

trusted to my experience of the exceptional case above narrated, these others would have been lost.

Three years ago a man was admitted into the Royal Infirmary, under my care, suffering from an irreducible omental scrotal hernia. By applying cold, moderate pressure, and enjoining absolute rest and low diet, I was able to return a considerable portion of the omentum, and he was dismissed relieved. About ten months afterwards he was again brought from a long distance to my care, suffering from symptoms of strangulation and peritonitis. The surgeon who had seen him had wished to operate, and urged him to submit, but, remembering his former recovery, he refused, and insisted on being brought to me. There was evidently a portion of bowel as well as omentum in the sac, and I told him there was no chance but by operating. I did so, and found the gut almost gangrenous, and he died in about forty-eight hours. This case, in contrast with the first mentioned, will show you the difficulty of being absolutely certain as to the cause of the symptoms arising in patients afflicted with irreducible hernia ; but I would advise you that, though there may be some doubt, whenever the symptoms are severe, or do not speedily yield to opiates, and cold to the tumour and other remedies, the safety of the patient is in operating. There used to be a good old general order in the British navy, issued to all commanders, as regarded the propriety of engaging an enemy of superior force, "When in doubt, *fight* ;" and in regard to hernia I would say, "When in doubt, *operate*."

The second class of cases I have referred to are those in which a hernia has apparently been reduced by taxis, and yet the symptoms of strangulation continue. When this occurs in the case of small herniæ, we at once conclude that the sac and its contents have been returned *en bloc* with the constriction remaining on the contained gut. But in cases of large scrotal hernia, for example, you might question the possibility of this occurring, and yet I have met with several instances. In these large herniæ we have seen that an old small sac, with its constricted neck, may be pushed down before a fresh protrusion.

In these cases the neck of the upper sac is wide enough to permit reduction of the mass of the hernia ; but a small portion of gut has got into the old small sac, and become strangulated ; and this has been returned *en bloc*. Such has been the condition I have found in the cases I have had to deal with, accounts of some of which will be found amongst the Clinical Cases. In such cases there should be no hesitation as to the line of practice ; the continuance of the symptoms are our warrant for operating. Though perhaps fairly reduced within the upper ring, the hernia cannot be far removed from the opening ; and by freely opening up the textures in the line of the canal through which it protruded, the surgeon is sure to find the strangulated mass, and can easily relieve it.

The sketch, Fig. 1, Plate li., was taken from the case of a patient who was sent to my care from the country. Three days previous to his admission into hospital a large scrotal hernia had come down, and he was unable to return it as he usually did. Symptoms supervened, and he sent for a surgeon, who, with some difficulty, reduced it ; as, however, the symptoms increased, he sent again on the second day for the surgeon ; nothing like a swelling could be felt, but suspecting the real state of matters, he sent the patient to me. On the most careful examination, I could detect no swelling, though from the dilated condition of the inguinal canal I could easily pass my finger up throughout its whole extent ; but I noticed, when he coughed, there was not the slightest tendency to descent of the rupture, and there was an indistinct feeling of some firm substance impelled against the finger. The man was evidently in a very dangerous state, almost in collapse, with constant hiccough and occasional vomiting. I laid the inguinal canal freely open, and divided the margins of the external oblique and transversalis muscles, to give me a full view of the parts. On doing this, and introducing my finger upwards, I felt a hard mass about the size of a small walnut, which was easily brought down into the wound, and proved to be a small subdivision of the hernial sac. This contained nearly four inches of

intestine, not distended, but closely packed and tightly strangulated. On dividing the constriction I found the gut quite gangrenous, and on drawing down the portion of intestine continuous with it, I found that the gangrenous condition had extended for upwards of twelve inches. The gangrenous portion was cut away, and the ends of the bowel stitched to the integument, to prevent retraction, as no adhesions had occurred. The appearance of the parts is shown in the sketch. The man rallied, and for some time seemed to improve, but the portion of gut strangulated had been high up in the jejunum, and he ultimately sank.

On the same evening that I operated on this patient, another man with a moderate-sized inguinal rupture was sent to my care. After cold had been applied, I reduced it without any great difficulty, and without giving chloroform. I applied a compress and bandage, and sent him to bed, expecting that he would be quite well next day. Next morning, however, I found he had been vomiting almost constantly, and complained of pain in the abdomen, near the site of the deep ring; he had also a quick pulse and anxious expression. No vestige of swelling could be seen or felt, but he complained of extreme tenderness at the point mentioned. His bowels had not been opened since the rupture first came down. From the ease with which I had reduced the hernia, and the sensation of its return, I could not believe any portion was strangulated; but the urgency of the symptoms, and the coincidence of the former case which I had just operated on, decided me on cutting down and examining the canal. I did so; but no protrusion appeared, nor could I feel any, though I slit up the parietes freely to make quite sure. But whilst the state of the patient, prior to the operation, was such as to indicate extreme danger, yet from the time of its performance all the dangerous symptoms disappeared. The intense pain and vomiting ceased immediately. The bowels were moved naturally the next day, and he made a rapid recovery. The results of these two cases, occurring as they did, formed a strong contrast, and warrant me, I think, in saying that safety lies in operating; and that, even though nothing be found, the patient is certainly not

placed in greater danger. I can hardly help thinking that in the second case some small portion of gut must have been reduced during the manipulations, without having been noticed, the relief was so immediate and complete.

In operating for strangulated hernia, as well as in reduction by taxis, a portion of gut may be pushed back with the constriction unrelieved. This is most likely to occur in operations for small herniæ, and especially when the extra-peritoneal operation is adopted, unless care be taken to empty the sac of its contents before invaginating it, and to avoid pushing a small rupture back *en masse*. In femoral hernia this might easily occur, if the operation be roughly or carelessly performed. But even when the sac is opened this accident may take place. I have in my private museum a small inguinal hernia, from a case operated on by an excellent surgeon and anatomist, in which the gut has been pushed up within the parietes, with a tight strangulation at the neck of the sac still remaining unrelieved. I have, from the time I examined that case, invariably used the following precautions in all cases in which I find it necessary to open the sac:—First, after dividing the constriction, I draw down, very gently, a fresh portion of intestine, to feel that the gut is free, and to ascertain its condition at and above the constricted point. Secondly, in reducing it I follow the bowel or omentum with my finger, to make myself absolutely sure that it is fairly lodged within the peritoneal cavity, and that no constriction can remain. In operating by the extra-peritoneal method, I never return the sac and its contents simultaneously, but empty the sac of its contents first. If I find any difficulty in doing so, I open the sac, so as to avoid all risk, and to leave no doubt on my mind as to the state of the parts. For whilst in a recent case I see no reason for unnecessarily opening the sac, I have no such dread of the effects of opening it as to induce me to run any risk of an imperfect operation. The great safety in strangulated hernia is early operation, performed carefully and deliberately, making sure of free, or at least complete, division of the constriction, and avoiding, as far as possible, fingering the in-

testine, or using much pressure to return it into the abdomen. When much pressure is required, the constriction is not sufficiently divided, and unless it be more freely relieved, the tense bowel will suffer if it be forcibly returned.

The SPECIAL HERNIÆ most commonly met with in practice are *Inguinal*, *Femoral*, *Ventral*, and *Umbilical*. The other forms, *Vaginal*, *Obturator*, and *Diaphragmatic*, are very rare. I have seen a vaginal hernia, but I never met with an obturator hernia in the living. The points in the abdominal parietes where herniæ protrude most frequently are the inguinal and femoral regions. The inguinal hernia is much more common in males than in females. I have not operated on more than four cases of strangulated inguinal hernia in women out of nearly 200 cases, and these I did not meet with till I had operated on more than 100 cases. The reason of this is, that in the female the canal, only transmitting the round ligament, is very small, and can scarcely be said to exist; the walls of the canal are in close apposition, except where the small cord-like ligament passes down. Again, in the female, the pelvis is very wide, and the space between the anterior superior spine of the ilium and the spine of the pubes being larger than in the male, there is a larger space between the vessels and the crescentic margin of Gimbernat's ligament, and therefore the weakest point in the female is in the femoral, whilst in the male it is in the inguinal region. At the same time femoral hernia is by no means uncommon in males, though not so common as inguinal hernia; but we require to operate very often for femoral in males, because it is more frequently irreducible from constriction than the inguinal. In the female, as I have said, an inguinal hernia is comparatively rare.

1. *Inguinal Herniæ* are divisible into two great forms, the *Oblique*, and the *Direct* or *Ventro-Inguinal*.

In an ordinary oblique inguinal hernia the protrusion passes down very nearly in the direction of the cord in the male and the round ligament in the female. If we trace it from within outwards, we find that it emerges, in the first instance, at what

is termed the deep ring or opening in the fascia transversalis. The sac of the peritoneum, containing the protruded viscera, descends from within this, and as it passes down it is invested by a thin layer of condensed fibro-cellular tissue, which may be looked on as an offset of the fascia transversalis, continued along the cord from the margins of the deep ring or opening. That opening, however, presents distinct margins of a resistant and somewhat aponeurotic character; the hernia protrudes through this opening, the peritoneal sac being of course carried before it, and forming a part of the protrusion. The protrusion passes down in front of the cord, insinuating itself between that structure and its different coverings as it passes down. In the first instance, therefore, it is covered by the fascia spermatica interna, or, in surgical language, the fascia propria—the prolongation of the fascia transversalis already mentioned. It then proceeds down the canal for about half-an-inch, where the lower margin of the transversalis muscle crosses it, next the lower margin of the internal oblique muscle also covers it in part, and just as it emerges from under the edge of that muscle, in the male, it receives a series of fibres coming from the internal oblique—the cremasteric fibres. In a case of inguinal hernia, the fibres of the cremaster are scattered and flattened out, mixed with condensed cellular tissue, and this has been termed the cremasteric fascia. The hernia then continues its course along the cord, and passes down, merely covered by the aponeurosis of the external oblique, till it arrives at the lower opening. At that point an inguinal hernia is generally prevented from passing lower down for a time, and merely bulges out, forming what used to be called a bubonocoele or proper inguinal, as distinguished from a scrotal hernia. From the margins of the external ring in the aponeurosis of the external oblique muscle it receives another covering, the fascia spermatica externa; and after this it is covered by the common superficial fascia and integument, and then passes down into the scrotum, receiving the different scrotal coverings. On looking at a case of inguinal hernia, as the surgeon cuts down upon it, the coverings are, the skin, superficial fascia, the fascia

spermatica externa, the intercolumnar fascia between the pillars of the external ring, the cremasteric fascia, the margins of the internal oblique and transversalis muscles which cross and overlap it, and, lastly, the fascia propria immediately investing the sac. While it is well to study these anatomical points, that the surgeon cutting down on the hernia may recognise these parts, yet you must not expect to see them as in dissection. You should examine preparations of herniæ, to recognise the morbid changes in structure in old herniæ. It is wrong, however, to say, as some do, that a knowledge of anatomy is of no use in regard to operating for hernia, for it teaches us not only to recognise textures when operating, but also to understand the direction of the protrusion and its relations to other parts, and hence is useful in regard to diagnosis and treatment, whether the latter consists in the taxis or the operation.

We must now briefly consider the course of a *Direct* or *Ventro-Inguinal* Hernia. This kind of hernia does not pass through the whole length of the canal; it emerges through some weak point in the conjoined tendons, from distension of the abdomen, or some other predisposing cause, leading to the formation of a weak point in these tendons. The hernia may either carry before it the fascia transversalis, or burst through it, as that fascia is very thin at this point. The protrusion therefore passes along only the lower part of the canal, and then directly downwards and forwards, so as to correspond at once to the lower or external ring. It very generally carries the then almost cellular portion of the fascia transversalis before it. Camper, however, was of opinion that it always broke through the thin fascia transversalis, and hence he stated that the fascia propria of a direct inguinal hernia was different from that of an oblique, and was formed by the intercolumnar fascia, or fascia spermatica externa, from the margins of the external ring.

The principal point of difference to consider is, that the direct or ventro-inguiual hernia appears on the inner side of the cord, and crosses and covers it at the lower part of the canal; whereas an oblique inguinal hernia follows the direction of the

cord, and crosses over the course of the great epigastric artery (*b*), running from without inwards, so that the neck of the hernia (*a*), where it emerges from the deep opening, corresponds at its inner side to the artery, while in the direct inguinal hernia the artery lies to the outer side of the hernia. This used to be considered of great importance as regarded the operation. In oblique inguinal hernia the rule was to turn the edge of the knife obliquely upwards and outwards, so as to avoid the deep epigastric artery ;

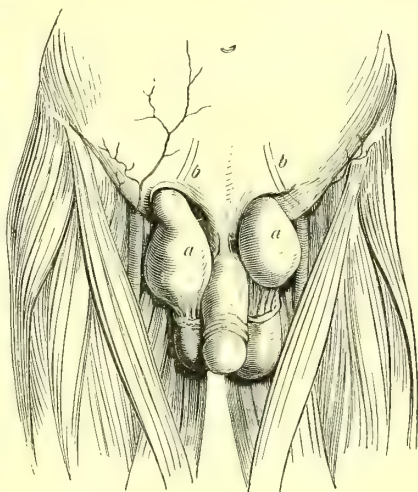


Fig. 36.

whereas in a direct inguinal hernia, if we divide the stricture by cutting outwards, we would be almost sure to injure the artery, and therefore the surgeon was warned that he must be very careful in deciding whether the hernia be direct or oblique. Sir Astley Cooper showed that practically we only require to divide the few fibres forming the constriction ; and if we carry the knife directly upwards parallel to the mesial line, so as to divide the constriction at its centre, there is no risk of wounding the artery whether the hernia be the oblique or direct form.

In regard to the DIAGNOSIS of inguinal hernia, I have already stated the absolute diagnostics of hernia, and these being kept in mind, I have now to bring before you what is sometimes termed the differential diagnosis, or the distinction between this form of hernia and other diseases occurring in the regions which it occupies. When the swelling is confined to the inguinal canal, the diseased conditions which are most likely to simulate hernia are, hydrocele of the cord, cystic tumors, or fatty accumulations developed in the canal in front of the cord, or abscess over the cord.

Encysted hydrocele of the cord at its upper part has a very close resemblance to a small inguinal hernia, but there is want of direct impulse, whilst we find irreducibility, tension, fluctuation, and dulness on percussion, without hernial symptoms; when the swelling is prominent, the light test for transparency can sometimes be applied. In most cases its defined form, and position in relation to the cord, together with the history and irreducibility, leave little doubt. But if such a case becomes complicated with symptoms of strangulation, there is no safe diagnostic, short of cutting down upon the tumour to make sure; for cases have occurred in which a small hernia had descended behind a hydrocele of the cord and become strangulated. Encysted tumours in the canal are rare, and when present, their globular form and the cord being felt free above the cyst, the mobility of the cyst, its irreducibility and want of direct impulse, are generally sufficient to settle the question of diagnosis. Fatty masses in the canal are not very common, and when developed high up, so as to cover the cord in the whole length of the canal, they present very much the feeling and character of omental hernia; indeed, it is almost impossible to distinguish them during life from small irreducible omental herniæ. Should symptoms of strangulation occur under these circumstances, and the surgeon cut down upon the swelling and encounter such a defined mass of fat, he must take care not to be thrown off his guard, but should slit up and examine the canal thoroughly, lest a small constricted rupture be also present. Abscesses, acute or chronic, sometimes occur in this region, and I have already spoken of these and their symptoms; but I cannot say that I have ever seen any case where there was difficulty of distinguishing between such abscesses and hernia.

LECTURE CXIV.

Differential Diagnosis of Herniæ *continued*—Diagnosis between Hernia and Inflammation of the Descending Testicle in Children or Adolescents: between Hernia and Hydrocele, Hæmatocele, Cirsocele, and Special Tumours of the Cord and Testis—Reduction of Oblique and Direct Inguinal Hernia by Taxis and by Operation in Adults and in Children—Modifications of Oblique Inguinal Herniæ—Congenital—Infantile.

THERE is one condition likely to simulate an inguinal hernia in the canal, which I have purposely refrained from speaking of, that I might draw your attention specially to it, as I have seen errors of diagnosis occur which might have led to very serious risk. I allude to cases in young children or adolescents, in whom the testicle has not descended into the scrotum. In such instances, from injury or some indefinite source of irritation, it sometimes happens that the testicle becomes inflamed and swells, and becomes as it were compressed or almost strangulated by the dense structures bounding the canal. Under these circumstances there is a tense and excessively tender elongated swelling, occupying the canal and bulging the intercolumnar fascia at the external ring; and along with these local conditions there are severe constitutional symptoms, vomiting, tenderness, and swelling of the abdomen, frequently constipation, and invariably a great amount of fever. The coincidence of such symptoms with tense, tender, and irreducible swelling in the inguinal region, excite suspicion of strangulated hernia; and even when, from examination of the scrotum and the history of the patient, you arrive at the conclusion as to the true nature of the case, still you will often feel anxious lest there may possibly be some hernial complication; and this, more especially, if the bowels do not act under the effects of medicine. In such cases you must take into account

all the circumstances. By applying cold over the swelling, or at a later stage by opiate fomentations, and the administration of anodynes, the swelling and painful symptoms usually abate. If, however, the symptoms become aggravated, I can conceive of the necessity for the surgeon cutting down upon the swelling to ascertain whether it be a hernia; and in case it was not, there would be no great harm done, the gland would be relieved from compression, and by a little gentle traction it might be brought into the scrotum. In all the cases I have seen, however, the symptoms have passed off under rest and treatment, without necessitating such an operation.

The diseased conditions which may simulate an inguinal hernia when it has descended into the scrotum are, Hydrocele, Hæmatocele, Cirsocele, and special tumours of the cord or testis. The distinguishing marks between hydrocele and hernia are, the general form of the tumour and its relation to the cord and testis. In an ordinary scrotal hernia, the protrusion having descended in front of the cord from above, the whole extent of the cord is covered by the swelling, and the testicle can be felt at the bottom of the scrotum below the hernia. Now, in hydrocele, the cord can generally be felt free in the inguinal canal and at the external ring, whilst the testicle cannot in general be felt, as the sac of the tunica vaginalis is distended round it. Then the swelling in hydrocele has no distinct impulse given it by the patient coughing; it has swollen gradually from below upward, there is dulness on percussion, and on examining it with the transmitted light of a taper it is generally transparent. In hæmatocele the weight of the swelling, its dulness on percussion, and the relations to the cord and testicle, as in hydrocele, together with the history of the case, are in general sufficiently diagnostic. In most cases of cirsocele there is really little or no difficulty of diagnosis, the relations of the swollen veins to the testicle, the peculiar sensation on feeling the distended vessels, the way in which they can be emptied by pressure when the patient is recumbent, and the manner in which the swelling gradually returns when the patient is erect, even though the finger is pressed on

the aperture, together with the worm-like sensation the distended veins have, and the peculiar kind of impulse when the patient is made to cough, are usually sufficient to decide the surgeon as to the true nature of the case. At the same time, I have seen some few cases where, from enormous dilatation of the veins, and from serum apparently being effused amongst the constituent textures of the cord, the swelling in cirsocele has very closely simulated a scrotal hernia.

Tumours of the testicle can hardly simulate hernia, but some soft malignant tumours of the cord closely resemble it as to position and relation to the testicle; but then all the other symptoms are different, and the history of the case is usually quite sufficient to decide its true nature.

We now proceed to consider the method of returning an oblique inguinal hernia by Taxis or operation. In this form of hernia the canal is oblique; and if taxis is to be applied here, let us see how it is to be done. It must, of course, be applied in the axis of the canal, *i.e.* obliquely, upwards and outwards, towards the anterior superior spine of the ilium, and the last part of the pressure must be applied directly from before backwards, when we have reached the upper opening. In applying the taxis we must bring down a little portion of the bowel, as before mentioned, to try and free it from the constriction. The obstacles to the reduction of this form of hernia by taxis are the margins of the external ring, which do not in general, however, form any very great obstacle: then there are the muscles covering the hernia, which should be relaxed: although they do not absolutely constrict the protrusion, yet they oppose reduction. It is at the deep ring and over the neck of the sac that the resistance is greatest; but it is only when there is incarceration that there is any difficulty, for in most cases of inguinal hernia we can put two or three fingers into the opening, and therefore the taxis is not generally very difficult.

In children the canal is not oblique, and the two openings lie nearly opposite each other. It is only as development proceeds that the canal becomes oblique. We must remember this as

regards the diagnosis of a direct from an oblique hernia, and also as regards the use of a truss in a child. By using a truss in a child, as I have already stated, at an early period, we often effect a radical cure ; so that when the child grows up the truss may be left off altogether. Even in the adult, in many cases, the canal looks almost direct ; and it used formerly to be of great importance to distinguish a direct from an oblique inguinal hernia. In probably nine out of ten cases an inguinal hernia is oblique, but the hernia presses inwards towards the inner margin of the ring, and dilates it, so that it comes nearly opposite to and in a line with the superficial or external ring, and it looks very direct ; but this is merely from the great dilatation of the deep ring.

In the OPERATION for inguinal herniæ the line of incision is much the same in either case, whether it be oblique or direct. Commence the incision well over the neck of the sac, corresponding to a point above where we notice the projection, because we want to expose and see clearly the parts at and above the neck. The length of the incision should be from two and a half to three inches. Even in a large scrotal hernia the incision should not be longer. We only want to make the incision over the canal. Beginning, then, above the neck of the sac, we cut through the skin and superficial fascia with one incision. I generally make this first incision from within outwards, by pinching up a transverse fold of the integuments and loose textures from over the protrusion, and transfixing it with the bistoury, the back of the knife being towards the hernia. I then cut out, dividing the fold, and extend the incision upwards and downwards, if necessary. In cases of gangrenous herniæ, or in those where, from inflammatory action, the superficial parts are matted together, the method just described cannot be followed. In such cases we must cut cautiously from the skin through the different textures, till we reach the sac. If any vessel, no matter whether large or small, begins to bleed, it must be secured, not so much on account of the risk from loss of blood, as that the hæmorrhage would interfere with the after proceedings. We

easily recognise the external oblique aponeurosis, which is generally distended by the hernia. We open the fascia at the lower part of the ring, and then with a probe-pointed bistoury slit up this fascia to the upper part of our incision in the skin. We have now before us the hernia covered by the cremasteric fascia, and we require to make an incision about an inch in length through that covering, by raising it with a pair of forceps, and opening it; then on a flat director we slit up this fascia, and the edge of the internal oblique muscle to the upper part of our incision. We are now upon the fascia propria of the hernia, which we next slit up. In the extra-peritoneal operation, it is at this point that we require to begin to clear the neck of the sac, which, if the incisions have been properly made, is now distinctly visible. We see the bulging above and below the constricted point. This constriction of the hernia we touch lightly with the knife, until we find the constricting fibres give way, and then we may attempt to reduce the hernia. If we cannot do this easily, and if we find that the constriction is in the neck of the sac, we must open it and divide the stricture from within. The sac must be very carefully opened. Sometimes the sac is not very easily recognised. We pinch up a portion with the finger and thumb, or we feel if there is anything gliding under the sac; if so, we raise it, cut a little bit of it horizontally, and then enlarge the opening. If no fluid escape, we should introduce a flat director, and make sure whether it is really the sac we have opened. If it be the sac, and if there be no fluid between it and the bowel, we then recognise the gut; but if we were to cut rashly, we might cut into the bowel. We open the sac, and enlarge the incision, upwards and downwards, then introduce the flat director under the edge of the constriction. A probe-pointed bistoury, laid flat upon the director, is glided under the constriction, and its edge is then turned upwards so as to divide the sharp margin directly at its centre. We can then get our finger so far under it as to feel the constriction and guide the bistoury. The director should not be used in dividing the deeper part of the stricture, but only to allow us to divide or notch the tight

margin, and then we can complete the division of the stricture more safely by using our finger as a guide. In operating on large scrotal herniæ great care should be taken not to open the sac too largely. It should be opened about an inch or little more below the neck, and slit up to the point of constriction, and then the stricture divided by the probe-pointed bistoury, guided on the finger or flat director. If this be done, and the constricted portion gently drawn down, and then returned, moderate equal pressure on the fundus and body of the sac made with the left hand, whilst the right hand regulates the neck of the protrusion, will usually suffice to reduce it, without any undue fingering or manipulation of the intestine. On the contrary, if this rule be not observed, and the sac be largely slit up throughout nearly its whole extent, the convolutions of the imprisoned intestine escape in all directions, twist upon themselves, render the division of the constriction more difficult, and, worst of all, require too much handling of the intestines to repress and reduce them. The same observations apply to all large herniæ. In certain cases, complicated by adhesions or other peculiar conditions, we must open the sac largely to examine and deal with the complications, whatever these may be; but such cases are exceptions to a great general rule. (See Plate lii. Fig. 2.)

In cases where the state of the hernia contra-indicates the extra-peritoneal operation, we open the sac without making any attempt to divide the constriction on its exterior. The sac is opened, and the constriction divided, as described above.

After the operation, a flat compress of lint, supported by a folded soft towel or napkin, and secured by the spica bandage, is applied. In applying the bandage the thigh should be slightly flexed on the pelvis, so that when the limb is stretched it becomes firmer.

The same general rules as to the extent and method of making the incisions, apply to the operation for direct or ventro-inguinal hernia as for oblique. We must, however, bear in mind the difference in the anatomical relations which I have previously alluded to. First, that the protrusion occurs through

Fig. 1

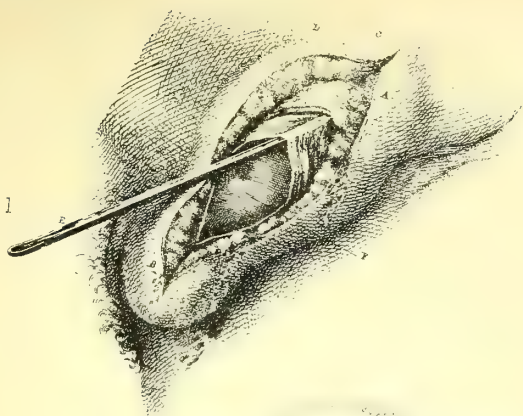


Fig. 2

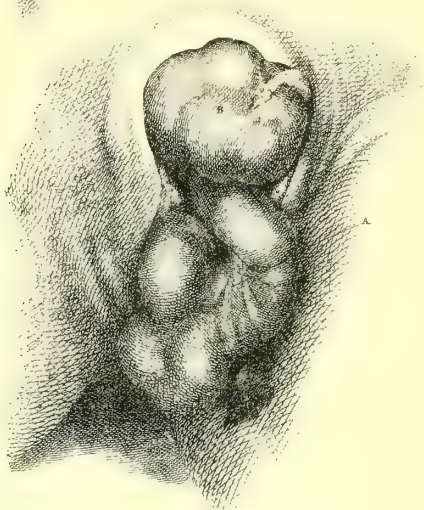
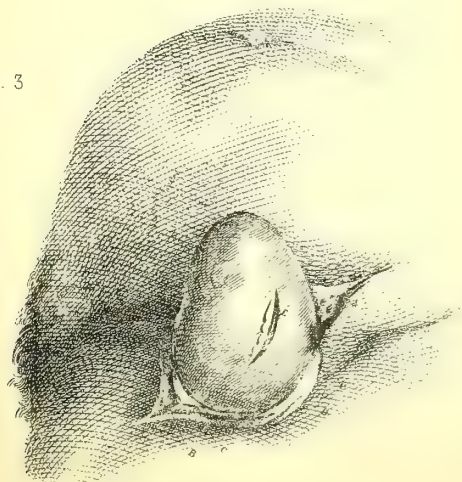


Fig. 3





some opening or weak point in the conjoined tendons, nearer the mesial line than the deep ring, consequently that the hernia only occupies the lower part of the canal, rather crossing the direction of the cord at its lower part, so that this form of hernia has fewer coverings ; it is only covered by the skin, superficial abdominal fascia, and the intercolumnar or external spermatic fascia,—sometimes termed the fascia propria of Camper,—and sub-peritoneal cellular tissue ; the coverings derived from the internal spermatic and cremasteric fasciæ being absent. Secondly, that at the deep part of the wound the relation of the neck of the protrusion to the deep epigastric artery is reversed ; for as this hernia protrudes nearer the mesial line of the body, the artery lies to the outer side of the neck of the sac. At the same time, if the incision of the deep constriction be carried directly upwards, parallel to the linea alba, as recommended in oblique hernia, the artery runs no risk. If, however, the edge of the knife is to be inclined to the side, it must be directed towards the internal side of the neck of the hernia. The after dressings and treatment are the same in both forms.

Hitherto I have been speaking of the two general forms of inguinal hernia, but under the head of oblique inguinal we meet with two important modifications of hernia—the congenital and infantile. Of these the former is the most common, and, I think, the most important, perhaps, of almost any modification of hernia that we meet with, both as regards diagnosis and treatment. The latter is not so easily defined, and I suspect the arrangement of parts must be often varied, to judge from the varying descriptions of it given by different authors. We must now turn our attention to these forms of inguinal hernia ; and first to the congenital hernia.

By the term CONGENITAL HERNIA we do not merely mean a hernia which comes down at birth, but we mean a hernia arising in connection with a peculiar congenital condition of the inguinal canal, which often continues to exist throughout life. The general sac of the peritoneum and the sac of

the tunica vaginalis, as you are aware, are originally one continuous serous sac. As the tunica vaginalis descends into the scrotum, the portion passing through the canal becomes narrowed, and bulges out when it emerges into the scrotum; thus two serous sacs are formed, connected by a narrow canal, which continues pervious till the birth of the child, when in general the communication becomes obliterated. It is usually said that the tunica vaginalis is drawn down into the scrotum as the testicle descends, but the tunica vaginalis is generally in the scrotum before the testicle comes down. When this continuity between the peritoneum proper and the tunica vaginalis continues after birth, if the canal does not become obliterated, then there is a narrow communication between the abdomen and the tunica vaginalis along the cord. A hernia or portion of bowel may descend through this narrow canal into or towards the cavity of the tunica vaginalis, and this is what constitutes a

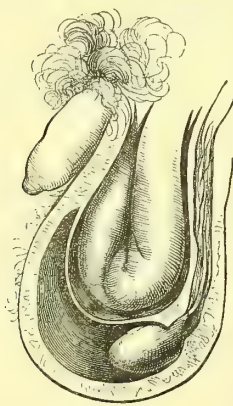


Fig. 37.

congenital inguinal hernia. The testicle is very often found lying in the canal, and the cord shorter than usual. When the hernia descends into the scrotum in such a case, the tunica vaginalis forms the sac of the hernia. In many cases, a portion of gut merely protrudes through the lower opening of the canal of communication just within the tunica vaginalis in the scrotum. The resistant character of the canal through which it has passed prevents more passing down, and in such circumstances there is a difficulty

in the diagnosis. In a strangulated congenital hernia, where we can see and feel fluid within the scrotum, with pain in the lower part of the abdomen, we may find nothing but what seems to be a thickened cord; yet, in some of these cases, we find that what appears to be a swollen spermatic cord is really a portion of intestine contained and constricted within the canal, and often tightly strangulated.

Fig. 37. Hernia Infantilis.

The reason why I draw your special attention to congenital inguinal hernia is, that it requires to be, if possible, more promptly attended to than any other form. The state of the parts and the degree of constriction are such, that bad consequences very soon follow any attempts at reduction, unless they succeed. In many instances, continued attempts at reduction do much harm. As regards the operation in congenital hernia, the extra-peritoneal operation is not suitable, as the neck of the sac, or the narrow portion of the canal, forms the constriction; and therefore, when operating on the adult, we must open the sac in all cases, to divide the stricture.

As regards the peculiar dangers of strangulated congenital hernia.—Any one who has carefully noticed the results of such cases must have been struck with the greater fatality in them than in other forms of rupture; whilst those who have had much experience in operating can scarcely have failed to be surprised at the amount of morbid action which is often presented in the contents of such a hernia in a very short period of time, compared with what we find even in cases of femoral or umbilical herniæ. These results seem to me to depend chiefly of course on the nature of the constriction, but are increased or modified by the extent of the protrusion, and the treatment adopted prior to operation. The very nature of the constriction is essentially dangerous; for if we consider the long narrow canal of communication which exists between the general peritoneal sac and the tunica vaginalis, and the process of condensation, elongation, and increased obliquity, which it undergoes as the patient advances towards adult age, we will at once perceive how difficult it will be for a hernial protrusion to descend; and having descended into the scrotum, and become distended or congested, how almost impossible to return it by taxis; especially when we further recollect the unyielding texture of the walls of the canal of communication in such a case. This resistant, unyielding character is easily seen when the hernia is down, and indeed often forms a cause of doubt as to the scrotal swelling being a hernia; for there is apparently no continuous neck pass-

ing towards the abdomen—nothing but what feels like a slightly swollen and hard spermatic cord, so firmly is the gut embraced throughout the whole length of the canal ; and then the bowel, emancipated in the cavity of the tunica vaginalis, becomes distended and congested, and tightly nipped above by the sharp resisting margin of the lower opening of the canal.

These are what I consider the essential dangers of the congenital rupture. But it is evident that they will be much increased, if, as often happens, a large portion of gut has suddenly been protruded, in consequence of some violent effort or force. Then, even slight efforts at reduction only make matters worse ; and in such a case I have seen the coils of small intestine highly inflamed, matted together, and at some points gangrenous, even in the course of sixteen hours ; whilst in another I have seen the peritoneal coat of the intestine abraded and cut by the stricture, and the bowel inflamed, in less than six hours from the time of descent, where the patient had been very restless, and had made violent efforts at reduction. On the other hand, if only a small portion of bowel has passed beyond the lower margin of the canal of communication, or where the bowel has been somewhat protected by a portion of omentum, I have found, even after the lapse of thirty hours, not much more alteration than in an ordinary case of hernia. In one case, that of a young man aged about twenty-one, who had suffered from hernia as a child, the hernia came down suddenly while he was at his work. I saw him sixteen hours afterwards, but on operating I found a very large quantity of gut in the tunica vaginalis, which was much inflamed and adherent. In another case, a man received a blow upon the testicle, and complained of pain and sickness when I saw him. The general opinion of others who saw him was that it was acute hydrocele. I thought, however, that it was a case of hernia, and I accordingly cut down upon it ; for even if it had been an acute hydrocele the incision would have done no harm, while, if it was a hernia, it was the only safety for the patient. I found a quantity of serous fluid very like that of a hydrocele, but on

further examination I found a small portion of gut tightly constricted and highly congested protruding into the upper part of the tunica vaginalis. The constriction was relieved, and the man recovered, but the diagnosis of the case was exceedingly difficult, and most of those who saw it thought it was merely swelling of the cord, arising from a blow on the testicle.

Attempts at reduction are not very likely to succeed, owing to the direction of the canal, except in young children ; in them I have frequently succeeded, but we should not try the taxis too persistently. In a young man on whom I operated without attempting the taxis at all, I found that the posterior part of the tunica vaginalis had been ruptured from the attempts at reduction which had been made before I saw the patient. In this case the tumour was confined to the canal, neither testicle having passed through the external ring ; the swelling was large, tense, and painful, and the patient had attacks of vomiting. All attempts by taxis had failed. My resident surgeon ordered a distending enema, and this brought away such a copious loose stool as to make me doubt the tightness of the constriction ; still, as the tumour was tender, I put the patient under chloroform, and cut down upon it, and found a large sac, partly occupying the canal, and partly pressing up between the parietes and peritoneum. On drawing it down, to bring its neck within easier reach, I found the sac had rent on its posterior aspect from the previous attempts at reduction, and on laying it freely open there was exudation of blood here and there on the surface of the bowel, showing the danger of the taxis in such cases. This patient ultimately did well.

There is no peculiar difficulty or danger in the operation. You make an incision over the swelling, and cut down upon the parts in the usual way. You must expose the inguinal canal and the upper part of the scrotum, and then you can easily divide the stricture without any danger, just as in inguinal hernia ; but to relieve the constriction you must divide the whole length of the canal of communication from its lower to its upper opening.

The after-treatment is similar to that of ordinary inguinal hernia—only we must avoid pressure on the testicle, if it lies in the inguinal canal. In some cases we can draw it so far down as to be able to apply the compress higher up. But in cases where the shortness of the cord will not admit of this, there is often difficulty in avoiding pressure upon the testicle in retaining the hernia, and even without direct pressure it sometimes inflames, swells, and gives trouble in the treatment of these cases.

INFANTILE HERNIA exists in different forms, and has been differently described by surgical authorities. The general characteristics are that it passes down behind, not into, the tunica vaginalis, very often splitting up the constituent parts of the cord from each other, so that it has the spermatic vessels sometimes on the surface and sometimes at one or other side. The principal peculiarity is, that in operating on such a hernia we first come down upon a serous sac, which when opened contains no gut. Behind this is some cellular tissue, and under this again is the sac containing the intestine. When operating therefore, if we remember that the part of the tunica vaginalis corresponding to the cord lies in front of the true hernial sac, we will be prepared to proceed without hesitation if we meet with this complication.

LECTURE CXV.

Femoral Hernia—Anatomy of the region in both Sexes—Comparative Frequency of Femoral Hernia in Males and Females—Difficulties in Diagnosis, and how to meet them—Reasons for operating early—Mode of operating—Ventral Hernia : its Nature and Treatment—Radical Cure of Hernia—Consideration of the various methods for effecting it—Statistics of Operations for Strangulated Hernia.

FEMORAL HERNIA can protrude only at one part of the abdomen. On looking at the interior of the pelvis and abdomen when the peritoneum has been stripped off, we notice that the fascia iliaca, as it passes down, is perfectly continuous on the outer side of the iliac vessels with the layer of fascia passing up to line the posterior abdominal parietes. In fact, there is no break in the continuity of these two fasciæ from the superior anterior spine of the ilium to the outer side of the femoral sheath, so that in this space no hernia can protrude. When the fasciæ arrive at the vessels, they arrange themselves into a funnel-shaped sheath to admit of the passage of the great vessels into the thigh. That layer of these fasciæ corresponding to the posterior aspect of the transversalis muscle passes down in front of the vessels, and can be traced continuously with the deep portion of the fascia lata, while the fascia iliaca, which passes behind the vessels, sweeps down posteriorly, or on a deeper plane, and corresponds to the pubic or internal portion of the fascia lata of the thigh. Where the vessels pass out, whilst there is a separation of these layers of fasciæ, they send down a septum between the vein and the artery. Besides this fascial funnel the vessels have also their distinct and proper cellular sheath, and this prevents any protrusion descending between the vein and the artery. But between the iliac vein and the pubes we have a space almost

unoccupied. This space is bounded on the inner side by crescentic fibres from the crural arch and from its falciform process, and also fibres from the lower pillar of the external oblique tendon and conjoined tendons, passing down towards the pubes, and towards the spine of the pubes, forming Gimbernat's ligament, or the crescentic margin of the crural arch. Behind, we have the pubes, covered by the pectineus and fascia; and in front we have the crural arch formed by Poupart's ligament and the abdominal fasciæ.

The space so bounded is one of the weak points of the abdominal walls; it is merely closed internally by a delicate layer of tissue derived from the transversalis fascia, called the internal cribriform fascia. There is often a sort of indentation corresponding to the space, which is filled by a small, deep, absorbent gland. This is the only point where a femoral hernia can protrude. The protrusion passes down on the inner side of the sheath of the vein, and

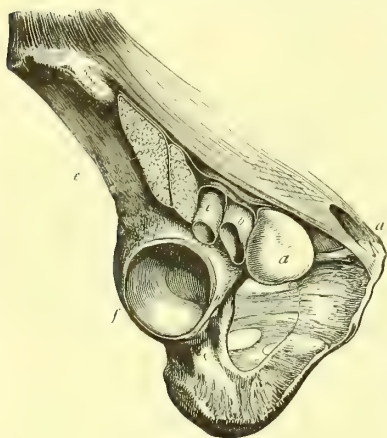


Fig. 38.

passes through the crural ring or canal, which is bounded in front by the crural arch, internally by Gimbernat's ligament or crescentic margin of the arch, behind by the fascia iliaca, and on the outer side by the sheath of the femoral vein. (Fig. 38.) Through this ring or space the hernia passes down and appears in the thigh, immediately below and behind the falciform edge of the fascia lata, which is stretched in front of it, and it lies upon the pubic portion of the fascia lata. The hernia is covered in this region by the cribriform fascia, the thin upper portion of which it either distends and carries before it, or it sometimes dilates and passes through one of the foramina in that structure. The relations of this cribriform fascia should be carefully studied, and

nothing in regard to the anatomy of femoral hernia has puzzled me more than to understand what can be the reason for such diversity of description and views as to the cribriform fascia; for, after many years' experience in dissecting and demonstrating these parts, together with careful examination of them for my own special satisfaction, I have not been able to see any reason for describing this cribriform fascia otherwise than as a continuous portion of the fascia lata, always presuming, of course, that no artificial dissection is made to separate the natural connections of the parts. If the subcutaneous superficial fascia be carefully raised, commencing over the saphena vein, and the fat be cleaned away with the handle of the scalpel, so as to expose the saphenic edge, the falciform process, and the fascia lata generally; we see between the falciform edge above, and the saphenic edge inferiorly, a continuous layer of fascia stretching from the iliac towards the pubic portion of the fascia lata; thinner, perhaps, and reticulated by foramina for vessels, but still perfectly continuous with the two great portions of the fascia. If the handle of the knife or a probe be passed under the saphenic edge, and pressed downwards, it is resisted in its progress, showing that here also, though the edge is abruptly reflected, the membrane is continuous, and above, at the falciform process, where the reflexion is less sharp, the continuity can be seen. It is only by artificial dissection that we can destroy this continuity, and make a distinct saphenic opening as it is called. As to the description of its being a portion of the superficial fascia of the thigh, that is evidently incorrect; for the saphena vein, the superficial branches of the common femoral artery, and their accompanying veins, together with the superficial set of femoral glands, form a natural separation between that fascia and the cribriform. As little do I see any reason for considering or describing the cribriform as a distinct structure, for any such distinction must be purely artificial.

As the space already described between the iliac vein and Gimbernat's ligament is wider in the female than in the male, femoral hernia is commoner in females than in males, though in

the latter it is not uncommon. When a hernial protrusion passes through the femoral opening, then, from the way in which the cribriform portion of the fascia of the thigh is arranged, the protrusion tends to pass up towards the abdomen, so that it lies obliquely, and resembles in some instances a small inguinal rupture, and this flexure of the body of the hernia upon its neck constricts it still further. If we attempt the taxis therefore, whilst the gut is in this position, we will simply bend it further upon itself, and cannot possibly reduce it. We must first bring the body of the swelling in a line with its neck, and the whole into the axis of the opening through which it has passed out. The hernia descends into the thigh through the saphenous opening at its upper part, but the term has given rise to much misapprehension, for it is sometimes understood to mean the saphenous edge or lower part of the saphenic opening; that edge is reflected back upon the vein, and therefore a hernia could never pass out there, unless it passed down between the vein and its sheath, and this it is said does happen sometimes, but I have never seen a case of it. At the upper part of the saphenic opening we have the weak point corresponding to the femoral ring, and when a hernia descends, it passes down immediately below the falciform edge, and invariably occupies the inner compartment of the fascial sheath.

A hernia which has emerged at the point just indicated, when of small size, passes at first directly down on the thigh, projecting the superficial cribriform fascia, glands, and skin, before it, and forms a small rounded or sometimes a flattened swelling at the upper and inner part of the thigh immediately below the crural arch. As the hernia enlarges, the connections of the cribriform fascia prevent it passing further down the thigh, and so the body of the swelling is pressed up towards the abdomen, and lies along the line of Poupart's ligament—its deep surface resting on the fascia of Scarpa, whilst its superficial aspect is in relation with the common superficial fascia of the groin, and the ascent of the swelling is limited above by the angle of union of the fascia of Scarpa with the superficial fascia of the abdomen.

The superficial inguino-pudic and epigastric arteries and veins are stretched over the hernia as it ascends. This hernia, therefore, whilst it will present all the usual symptoms absolutely diagnostic of hernia in general, requires great care on the part of the surgeon to distinguish between it and other swellings occupying the same or nearly the same position. The difficulty in diagnosis will be increased if the swelling be of small size, or if the protrusion be largely composed of omentum, for in these circumstances the important diagnostic of direct impulse on coughing is often very imperfect, even when the hernia is not constricted. In a tightly-constricted hernia there is no direct impulse, as I have already pointed out.

The diseases in the inguino-femoral region, which may be mistaken for femoral hernia, are, enlarged and partially suppurating glands, chronic abscess of the iliac fossa pointing or projecting at the femoral ring and taking the same position as the hernial protrusion, varicose dilatation of the femoral vein, cystic and fatty tumours, and psoas abscess. Besides these distinct diseases the surgeon requires to diagnose this hernia when it is reflected on the abdomen, from a small oblique inguinal hernia. As one or more of the inguinal glands lie directly over that portion of the cribriform fascia which a femoral hernia pushes before it, you will easily understand how closely such an inflamed and swollen gland may simulate this hernia ; indeed, as I have seen, you may have both conditions present, and on cutting through the suppurating gland you may expose a small hernial sac, but in such cases the general symptoms will so far guide your practice. If the bowels act freely under the use of castor-oil or other gentle purgative, and there be no vomiting, and merely the tender swelling, and the skin not easily movable over the tumour, the diagnosis is, that it is an inflamed gland. If, moreover, you detect any cause of local irritation likely to lead to such glandular swelling, and if the tumour, at first comparatively small and hard, gradually becomes larger and soft, or fluctuating, with red adherent skin, and general feverish symptoms, this diagnosis is strengthened. But if the

swelling is at first deep seated, with impulse on coughing, and can be reduced, it is hernial. If, with all clear indications of an inflamed or suppurating gland, the symptoms of acute incarceration or strangulation supervene, these should decide the prompt interference of the surgeon, by cutting down on the swelling; and should his incision expose an inflamed gland or give vent to purulent matter, he must not be thrown off his guard, but proceed, and make quite sure lest there be a small hernia present. I recollect, when a student, reading a criticism in a medical journal on a hospital surgeon for operating on a case of supposed femoral hernia. The article was headed, "Opening an abscess by a T incision!" Though I have since then seen a good deal of surgical practice, I know of no deadly results which would be likely to follow opening an abscess by a T incision, but I do know that leaving a hernia strangulated would be fatal.

Chronic abscess formed in the loose subperitoneal cellular tissue on the surface of the fascia iliaca makes its way towards the weakest point in the same way as the hernia, and therefore bulges at the femoral ring. There is impulse on coughing, the swelling can be reduced, and even for a time retained by the finger after reduction; and except, perhaps, that it wants the firm elastic feeling of hernia, the symptoms are very similar, and the surgeon may be misled by the patient stating that the lump appeared suddenly after violent coughing or some other exertion. But, if there be a circumscribed fulness of the parts above Poupart's ligament, when the swelling is repressed, if the patient be pale and unhealthy-looking, or if there be pain in the back, suspicion should be aroused; and if the patient has been trying a truss, and finds that the swelling always manages to escape from under the pressure, the nature of the case becomes more apparent, and gradually the increase and character of the swelling leave no doubt of its true nature. But at first the difficulty of diagnosis is considerable.

In psoas abscess, which arises under the fascia iliaca, there is not in general any real difficulty in diagnosis; the matter points lower down, bulging the fascia lata before it, and its position, in

conjunction with the history of the case, leaves little doubt as to its character.

Varix of the femoral vein, distending and pressing out the thin fascia on the inner side of its sheath, has somewhat the appearance of a small hernia; but the sensation to the finger is quite different, and, moreover, it must be very rare indeed that varix of the femoral exists without a varicose condition of the saphena and other veins of the lower extremity, and this will generally give a clue to the nature of the swelling.

Except when symptoms of strangulation exist, cystic and fatty tumours in the femoral region will be distinguished from hernia by their form, feeling, want of direct impulse, and irreducibility. They may, however, prove puzzling to the surgeon when operating for symptoms of strangulation. I have in several cases met with such cysts overlying a hernia. In one case I found no less than four cysts about the size of large grapes under the fascia overlying a small strangulated hernia, and when I opened the first, I thought, from the escape of serous fluid, that it was an empty hernial sac, but on perceiving the others I saw their real character, and dissected them off and exposed the true sac.

As regards the diagnosis between femoral and small oblique inguinal herniæ, I have never found any great difficulty in distinguishing them. Though a femoral hernia does ascend obliquely towards the abdomen, it does not pass up to the level of, nor in the direction of, the deep abdominal ring. The connection between Scarpa's fascia and the common superficial fascia a little above Poupart's ligament prevents it ascending far, and so it passes more transversely out towards the iliac spine, and does not present the obliquity of an inguinal hernia. Besides, unless the sac and its fascial coverings have become adherent to the adjacent textures, we can, even in strangulated femoral hernia, bring down the tumour from off Poupart's ligament, so as to ascertain distinctly its relations and the point from which the neck emerges. It is only in old adherent and irreducible herniæ that difficulty in diagnosis between the two forms can occur.

The crural arch is of great importance in reference to the taxis and operation, and considered anatomically it is a very complicated structure, but we have not time to enter fully on the subject here. I would merely refer you to the simple and comprehensive statement given by Mr. Liston of the disposition of the lower crural arch, as distinguished from Poupart's ligament—which I have verified in its main points in a very large number of dissections—as a model of anatomical description. He explains that the iliac portion of the fascia lata, together with its falciform process, is formed by the union of the deep layer of the abdominal superficial fascia (Scarpa's fascia) with the fascia transversalis, below Poupart's ligament; which ligament lies enclosed between these two laminae, above their angle of junction, so that the combined fasciæ referred to, form in fact the resisting portion of the arch which is in contact with the neck of the hernial sac. This can be proved by dividing and removing Poupart's ligament, and rendering tense the fasciæ, when the constricting edge will still be felt. The only point of description in which Mr. Liston's views are defective in regard to these structures is, that he did not keep sufficiently in view the strong attachment of the deep layer of the structure to the posterior reflected edge of Poupart's ligament, and the tension consequently exerted upon that ligament by the fascia lata in certain positions of the limb. In applying the taxis in femoral hernia, we are told to flex the leg on the thigh, and the thigh on the pelvis, and rotate inwards. How does this affect the crural arch? It cannot affect Poupart's ligament directly, because this stretches between two fixed osseous points, and it is only in so far as it is curved downwards by its attachment to the fascia lata that we can act upon it at all. It is only by acting on the falciform edge that we can relax the lower crural arch. As the fascia iliaca and fascia transversalis pass down, Scarpa's fascia, which is the deep layer of the superficial abdominal fascia, becomes perfectly continuous with the anterior layer of the iliac or outer portion of the fascia lata; whilst behind Poupart's ligament the fascia transversalis descends and becomes continuous with the posterior or deep sur-

face of the fascia lata, and these two laminae close below Poupart's ligament, and form the falciform process, and the lower crural arch the constricting edge. In the taxis, therefore, we relax this edge, but scarcely Poupart's ligament.

In applying the taxis, after using the general means formerly mentioned, we bring the tumour, if it be a large one, from off the surface of the abdomen, and press it directly upwards, after bringing it into a line with the axis of the opening through which it has passed. In most cases, at an early period, we can thus reduce the hernia easily, but sometimes the textures offer great resistance to reduction, and the bowel becomes so altered in its relations and proportion to the opening, that we can no longer return it.

If left long unreduced, the sharp margins of the constriction would cause great mischief, and therefore in femoral hernia operation should be resorted to early. In operating for femoral hernia, we should see the falciform edge and parts immediately over the neck of the sac. We therefore make an incision, with this object, over the whole length of the tumour, if small from above downwards, and I generally make another slightly oblique along the line of Poupart's ligament. In very fat patients I make a crucial incision. I then divide the skin and superficial fascia, push aside any glands, and secure any vessels which may bleed.

When the superficial fascia is fully divided, the body of the hernia is released, and appears like a rounded protrusion lying loose, and generally tilted up over Poupart's ligament, as shown in Plate lii. Fig. 3. The smooth texture covering the hernia is generally the cribriform fascia, but we may have to cut cautiously through two or three layers of condensed cellular tissue before we come to the sac. We should try the extra-peritoneal operation, if the hernia has not been very long down, for we see the neck of the sac very distinctly, and by touching the constriction lightly with a bistoury, we cut through the resisting fibres. If we find that the indentation is effaced, and that the sac becomes more distended, then the constriction is

divided, and we next empty the sac of its contents and reduce them. But if we cannot do this, we must open the sac and divide the constriction from within. In small femoral herniæ we must do this very cautiously, for there is often no fluid in the sac, and recent adhesions may even have taken place between the bowel and the sac. We should introduce the finger, and feel whether there be adhesions. In dividing the stricture in femoral hernia, the surgeon passes his finger or the flat director in front of the bowel, and somewhat to its inner side, and with a bistoury introduced flat on the finger he insinuates its point through and beyond the constricting edge, then turning the edge of the knife upwards and inwards, he divides the falciform edge and the deep crescentic margin, or Gimbernat's ligament. When the deep crescentic margin is divided we at once relieve the falciform edge and the constriction, and the bowel can then be reduced. The case is treated afterwards like any ordinary case of hernia. We should not carry the knife directly upwards, but obliquely upwards and inwards, so as to divide the crescentic margin where it forms the upper and inner part of the ring. By doing so we avoid all risk of injury to the vein or to the epigastric artery, or the spermatic cord in the male.

As regards the dangers of the operation, there are hardly any incidental to the operation itself if it be properly and carefully performed; we simply divide the skin and fasciæ, and sometimes also the sac. The only vessels which require to be divided are the branches of the inguino-pudic artery. They are generally cut in the first incision, and should be secured at once as divided. The obturator artery sometimes courses close round the inner side of the neck of the sac in femoral hernia, and under such circumstances it has been wounded in dividing the constriction. This occurs when the obturator arises, in common with the deep epigastric, by a long common trunk, which, after ascending on the parietes, sends off the obturator, which in passing to its destination, lies so as to be in the relation above mentioned. In the cases where the obturator comes off from the external iliac artery, it lies beneath a hernia passing

through the femoral canal, and consequently can be in no danger. In one remarkable case, on which I operated, the irregular

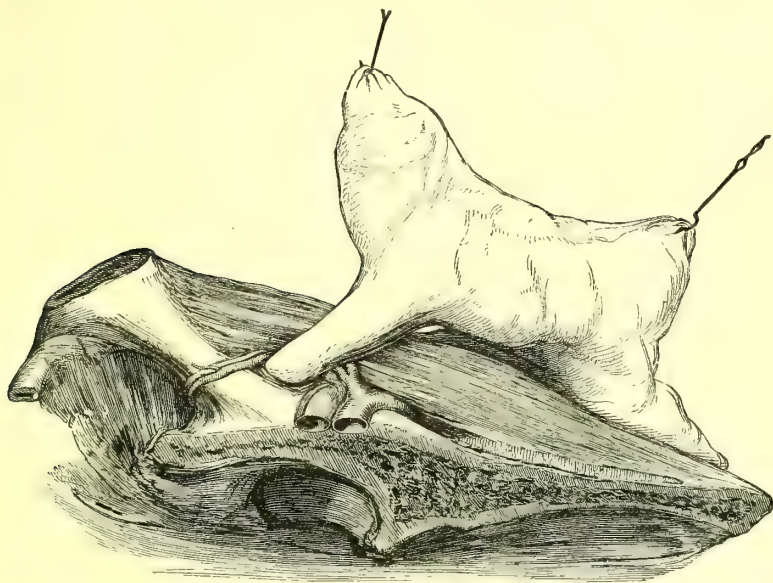


Fig. 39.*

obturator artery so constricted the large intestine forming the protrusion, that I was obliged to tie it with two ligatures, and divide it between them before I could reduce the hernia. The case will be found detailed amongst the Clinical Cases; but it is unique, I believe, and I think rather proves that in ordinary femoral hernia, wound of the irregular artery may be avoided, if care be taken to examine with the finger before dividing the deep constriction.

UMBILICAL HERNIA, as the name implies, protrudes at the navel. VENTRAL HERNIÆ may protrude either in the mesial line, or at one or other side. In all these cases the gut comes

* This woodcut was taken from a case operated by the late Dr Richard Mackenzie. The obturator, which encircled the neck of the sac, escaped division. I am indebted to Professor Struthers, of Aberdeen, for the use of the woodcut. A notice of the case, by Dr. Struthers, will be found in the *Edinburgh Medical Journal*, July 1855, page 74.

through a distinct circular opening of a dense aponeurotic character, the thinned edges of which are prolonged over the hernial sac, forming a sort of fascia propria. In many cases the hernia is very large. Sometimes it contains the larger portion of the floating viscera of the abdomen, the abdomen itself being contracted, and not having capacity to contain the viscera, which have made for themselves a sort of new cavity under the skin and fasciæ.

In reducing an umbilical or ventral hernia by the taxis, the patient should be placed with the shoulders raised, and the lower limbs flexed towards the belly, so as to relax the abdominal parietes. We first try to disengage and draw down the neck, and then gathering the body of the swelling, and raising it slightly, we press it directly backwards in the line through which it protruded. In large umbilical herniæ, even when reducible, the reduction is not very readily accomplished, owing to the difficulty of managing such a bulky mass. Another cause of difficulty is that most umbilical or ventral herniæ contain a large amount of omentum; and this, when long out of the abdominal cavity, becomes loaded with fat, and so altered in form as not easily to pass back through the opening, the margins of which are very resistant.

In operating for these herniæ, if we were to make an incision corresponding to the bulk of the tumour, or a crucial incision, the consequence would be that the bowels would come out by it, and, instead of facilitating matters by a free incision, we should only make them much worse. No matter what the size of the hernia is, the incision ought to be small. We require to make an incision $2\frac{1}{2}$ or 3 inches long, beginning about an inch above or below where the hernia protrudes, and continue it down over the tumour. We first divide the skin and superficial fascia, and then we come down upon the thin fascia immediately investing the hernial sac. In one case I found the fat under the skin in contact with the omentum, the sac being apparently worn through at one point by the pressure. In general, however, the sac is well defined, and after dividing the skin and

superficial fascia we can draw down the tumour, and the constriction becomes apparent. In performing the extra-peritoneal operation in ventral herniæ, we divide the textures very carefully till the constriction ceases to exist, cutting directly upwards. In most cases, however, it is better to open the sac by a small opening, and introducing the finger, feel till we come to the point of constriction, then introduce a director, and divide the constriction upwards for about a quarter of an inch. We must be careful that the bistoury has the probe on the end, and not on the back, for the stomach and colon are sometimes displaced and distended in umbilical herniæ, so that they might be injured by the point of the knife. Another thing to be attended to is, that when we require to divide the constriction freely in a very large hernia, instead of dividing further up in the mesial line, we may either draw up the hernia and repeat the incision below, or we may divide the constriction at the sides to a certain extent. It is a complete circular constriction, and we may relieve it in this way by division of different parts of the circle. The hernia is then left with the skin and sac upon it, and we can gradually reduce it bit by bit.

Sometimes, in old umbilical herniæ, the convolutions of the bowel are contained in hollows in the cellular tissue, so that we require some little time to reduce the hernia. In other cases the bowel is adherent; but if the constriction be divided that is the main point. As regards a large incision, I can only say that I have seen it once, and I would never wish to see it again, for the whole convolutions of the bowel were spread over the abdomen, and it was very difficult to get at the constriction. A moderate incision is quite sufficient, owing to the comparatively superficial position of the protrusion, which is just under the skin and superficial fascia. In some cases where, in operating, we find a large mass of omentum altered in form or adherent, it may be necessary to enlarge our incision, to enable us to see the state of the omentum, and judge whether we should return it by manipulation, or remove it after ligature of the vessels at its root. In such circumstances, however, we ought first to reduce all the

intestine before proceeding to enlarge the incision, in order that the convolutions may not protrude and embarrass us, or run the risk of injury.

As regards large portions of omentum, either in this or other forms of hernia, if much manipulation is likely to be required to return it, bad consequences are apt to follow, so that I believe it is better, in many instances, to remove the mass entirely, or in part, rather than continue efforts to return it, as it is very apt to take on a sloughy action. When the hernia is reduced, and the wound closed, we require to apply a compress of lint and a folded towel, supported by a broad binder or flannel bandage.

When lecturing on the subject of reducible hernia, and the palliative treatment by trusses, I stated that the consideration of the *Radical Cure* would be better appreciated after discussing the special herniæ. The radical cure of hernia, though it has of recent years attracted attention, and been brought prominently before the profession, has from time immemorial been attempted to be obtained by various methods—by operation, or otherwise. Thus, the application of medicated compresses or plasters, combined with rest in the horizontal position for weeks or months, at one period had its successes and its advocates; and as for operative procedures having the same object in view, their name is legion, and they have been practised from the days of Abulcasis to the present time. I can merely name some of the general plans, such as exposing the sac, and, after reducing its contents, applying the heated cautery to the exterior of the neck of the sac; or even opening the sac and cauterising the interior by actual or potential cautery—ligature of the neck of the sac, so as to cause consolidation and obliteration—incision of the sac—excision of the sac, either by dissecting it from the scrotum, or partial excision of a part of it. The last-mentioned plans were the operations which, together with lithotomy, at one period formed a specialism as we would now call it, in the hands of itinerant operators like Franco and Frere Jacques;—some of them, however, so ignorant, both of the anatomy and functions of the parts, that we are told

they very generally simplified their proceedings by making a clean sweep of the testicle as well as the sac.

In 1830 M. Belmas re-excited attention to this subject in France. His method seems to have been not unlike Gerdy's and Würtzer's methods. It consisted in inserting and fixing a small bag of goldbeater's skin in the upper part of a hernial sac, leaving it there to excite inflammation and consolidation of the neck of the sac. His first operation succeeded, without inducing any bad symptoms. In another case, however, operated on at his request by Baron Dupuytren, though the patient ultimately recovered, he very nearly succumbed from peritonitis; and in other cases subsequently operated on by M. Belmas, the risks seem to have been so great as to deter others from adopting the plan; and whilst the radical cure was still considered theoretically as a result which might be obtained at certain risk, surgeons were content, as a general rule, to trust to the palliative method by retentive apparatus.

Of late, however, attention has again been drawn to the subject, and various plans adopted with more or less success, and, so far as published results show, with less risk to life. The part of the question which I feel most doubt regarding is, the permanency of the cure. From what I have seen of some cases in which I had operated for strangulated hernia, and where great consolidation and apparently obliteration of the sac had occurred, I have for a time hoped for a radical cure; but in all of them the consolidated mass gradually became less, and was carried down before a fresh protrusion, and the same has been my experience in cases operated on by Würtzer's plan, and the various modifications of it. In regard to the general question, my own opinion is, that whilst in certain cases where the herniæ cannot be easily retained by trusses, or where circumstances render the patient anxious to try the radical cure, the operation to obtain that may be performed; yet I believe that in the great majority of instances, owing to the risks and uncertainty of absolute permanent retention without the use of a truss, the palliative treatment by trusses is preferable. In young children,

as I have already pointed out, the truss, properly and persistently applied till the development of the abdominal parietes, increases the obliquity of the canal, causes a really permanent cure in most instances ; and in children I therefore consider operative procedure unwarrantable.

The principles of the operations of Gerdy and Würtzer for the radical cure of hernia are nearly the same. They both consist in invaginating the sac and superimposed integuments after returning the contents of the sac, without any preliminary incision, and then carrying a needle through the upper part of the sac and the skin. By means of the strong thread with which the needle is armed, a plug of wood, gum elastic, or a portion of wax candle proportioned to the parts, is drawn up through the whole extent of the invaginated textures, and fixed by tying the thread, and applying a compress over all. The plug is generally anointed with some irritating substance to cause excoriation of the invaginated skin, so as to make its opposed surfaces adhere when the plug is withdrawn, and, finally, firm compression kept up for some time. In Würtzer's method these objects are effected by a special apparatus, but for my own part I prefer the finger to guide the needle, so as to be sure that no portion of gut has fallen down after having been reduced. In operations performed on these plans it has been found, as I have stated, that though successful for a time the protrusion often recurs.

The method of Professor Wood, of King's College, London, seems to me to promise more permanent chances of success, though not devoid of risk. The principles of Professor Wood's operation are, limited incision of the superjacent tissues to insure proper invagination of the textures, and enable the needle to be carried with certainty and safety in the directions described. But his special object is not merely invagination of the sac and skin, but to carry the needle and copper wire suture in such directions as will enable him to draw together the aponeurotic or fascial margins of the openings through which the hernia has descended, close these openings, and narrow the

canal. It is impossible, however, to describe satisfactorily the details to be attended to in performing these special operations without quoting very largely from Mr. Wood's work, and as abridged descriptions of such procedures are apt to mislead, I would refer you to Mr. Wood's monograph on the subject for details.

I referred at page 1162 to the results of 127 cases of strangulated hernia on which I had operated. These results were collected many years ago, and since then I have operated on a large number of hernial cases; but as I have not been so careful or methodical in noting results as I formerly was, I subjoin the brief summary of cases referred to, as a contribution to the general statistics of strangulated hernia.

SUMMARY OF 127 CASES OF STRANGULATED HERNIA.

Nature of Hernia.	No.	Recovered.	Died.
Inguinal* . . .	46	38	8
Femoral . . .	77	60	17
Umbilical and Ventral	4	3	1
TOTAL . . .	127	101	26

Of 46 Inguinal Herniæ, 4 occurred in females.

„ 77 Femoral „ 14 occurred in males.

The Umbilical and Ventral Herniæ all occurred in females.

The causes of death in the 26 fatal cases were as follows :—

In 17 cases the bowel was distinctly gangrenous.

„ 7 „ peritonitis had commenced prior to the operation. (Four of these were cases of congenital hernia.)

„ 1 „ pyæmia proved fatal on the eighth day.

„ 1 „ melæna was the cause of death.†

26

The age of patients on whom the operation has been performed is not unfrequently made the subject of notice in me-

* Of the inguinal herniæ, 8 were congenital herniæ, and of these 4 died.

† In this last case the protrusion, a large scrotal hernia, was returned with great ease by the extra-peritoneal operation, within sixteen hours from the time of its descent; but the patient, before applying for medical aid, had resorted to most violent efforts to reduce it.

dical journals. I have repeatedly operated both on males and females above 80. The youngest patient I have operated on for strangulated hernia was between eight and nine months old. My oldest patient was a woman who had completed her 98th year two days previous to the operation. She made an excellent recovery, and I believe lived to complete her 100th year. The infant above alluded to also did well. Except as a matter of curious interest, however, I cannot see what the age of the patient has to do with the propriety of performing an operation of necessity such as that for strangulated hernia.

In connection with the subject of Hernia, I would briefly allude to the question of surgical interference in cases of obstruction of the bowels from *internal strangulation* of the intestine, or from intus-susception. From what I have said in favour of operative interference in cases in which a hernia has been reduced *en masse*, the symptoms of strangulation remaining unrelieved, you might naturally conclude, that operation was equally imperative in the cases of internal obstruction. The conditions, however, are really very different. In cases of intus-susception or internal strangulation, we have not the same certainty, either in regard to diagnosis as to the cause of obstruction, or as to the position of the constriction, if it exist, or even as to our power to relieve it when found. I have repeatedly seen in *post mortem* examinations, the small intestine so twisted that when fully exposed the adhesions and constriction could not be relieved; and in cases of intus-susception at the period at which we would be warranted in operating, the adhesion and sloughing of the invaginated portion of bowel would generally render the operation useless. Again, in many cases of obstruction in which I have been consulted and advised delay, I have seen the patients recover under the use of calomel and opium, so that I cannot look upon the operation of gastrotomy with favour, nor can the circumstances of the class of cases for which it has been proposed be considered as analogous to those of strangulated hernia.

LECTURE CXVI.

Injuries of the Bladder and Urethra : their Dangers ; Treatment—Stone in the Bladder : Causes ; Symptoms—Diagnosis between it and other Diseases—Prognosis as to result of Operations, according to the Nature of the Concretion.

I NOW pass on to treat of the injuries and diseases of the pelvic viscera, commencing with those of the genito-urinary system.

INJURIES OF THE BLADDER or urethra may occur as the result either of penetrating wound or of force directly applied ; or from indirect force in certain injuries of the pelvis. The most frequent site at which the urethra is wounded or lacerated is in the perineal portion of its course. In this position I have seen several cases of direct wound from persons falling on some sharp substance ; in some of the cases, in young children, it occurred from the breaking of an earthenware chamber-pot. In these cases the wound attracted immediate attention, and prompt treatment. The catheter was introduced at once, and retained for twenty-four or forty-eight hours, until the soft parts in the perineum were glazed with lymph, and then introduced occasionally from time to time until the wound finally closed, and also for some time subsequently, to prevent the contraction giving rise to stricture. All the cases of this kind which I have seen, did well at the time ; but I have had to treat some of them in after years for very bad stricture, owing to their neglect of the occasional introduction of an instrument.

In such cases, when the superficial wound is small, or the soft parts over the wounded urethra imperfectly divided, I would advise the practice I have always adopted of dilating the wound freely in the line of the raphe of the perineum, to afford free outlet for the urine, pus, and sloughs of cellular tissue.

The urethra may also be lacerated without any external wound in the perineum, in consequence of the person falling astride a bar or rope, or from some similar accident ; or in consequence of indirect violence, as, for example, from a weight of earth falling on the lower part of the back when the person is stooping. Such an accident may cause more or less separation of the sacro-iliac synchondrosis, or even of the pubic symphysis, and the membranous portion of the urethra gives way at its inferior aspect. Hence, in all cases where we have injury of the pelvis, it is a wise precaution to pass a full-sized catheter at once, before the patient tries to make water, for, if the urethra be ruptured, part of the urine would be extravasated into the tissues, and give rise to infiltration of urine, with all its disastrous effects. In the cases where the urethra is ruptured from the person falling directly upon the perineum, there is generally bleeding from the orifice of the urethra, and extravasation of blood into the textures of the perineum. The latter condition is sometimes the cause of considerable difficulty in passing a catheter into the bladder, for the extravasated blood displaces and compresses the torn ends of the urethra, so that they no longer correspond. The treatment in such injuries is to pass a gum elastic catheter into the bladder at the very first, before much effusion of blood has occurred, as the catheter can then be generally passed with ease, if the point is kept bearing gently along the upper or lateral portion of the canal, so as to prevent its point passing through the laceration, which is almost invariably in the floor of the urethra. When much blood is effused it requires great care and skill, by gentle and patient manipulations, to guide the catheter along the canal. So great indeed may be the difficulty that you may even require to incise the swollen perineum, to turn out the clots ; and then, with the finger in the wound, guide the catheter onwards, or open the urethra further back. If the patient has attempted to pass his water, and there be much swelling in the perineum, an incision in the line of the raphe should be made at once, as the probability is that the urine will have been extravasated amongst the coagula, and unless it gets vent, it will lead to very serious,

if not fatal, consequences. In all such cases the catheter must be kept in the bladder for a day or two.

The urinary bladder is so placed in the pelvis as not to be exposed to much risk from penetrating wounds of the abdomen, unless these pass obliquely from before downwards and backwards, or unless the bladder be distended so as to have risen above the pubis at the time of the injury. In fractures of the pelvis, however, sharp projecting portions may perforate the viscus, or it may be torn by the force causing the injury. When the bladder is much distended, it may be ruptured in consequence of the patient receiving a blow on the abdomen, or by his falling, or running against a post. In such circumstances the rupture usually takes place towards the posterior aspect of the superior fundus, and consequently the urine is effused into the peritoneal sac amongst the viscera. In other cases where the blow has been received just above the pubis, the anterior wall of the distended viscus yields below the reflexion of the peritoneum, and then the urine is extravasated into the cellular tissue of the pelvis and iliac fossæ. In either case the injury is one that leaves small chance of recovery. In the rupture immediately above the pubis there is some slight chance of recovery if prompt treatment be adopted—by incising the integuments and *linea alba* at the lower part of the abdomen, whereby an outlet is afforded for the urine and sloughing cellular tissue; then introducing and retaining a vulcanised india-rubber catheter in the bladder, taking care to change it every second day, and at the same time watching the constitutional symptoms and supporting the patient's strength. Even in the case of rupture of the distended bladder into the peritoneum, there is one case of recovery on record, regarding which, from the history of the case and the symptoms, I think no reasonable doubt can exist that the bladder was ruptured above the peritoneal reflexion. When this case was first published, it was objected, that, with the exception of the urine first drawn off, there was no bloody urine. But this is not wonderful, for the bladder, in its ordinary condition, is not very vascular. And as to matter of fact, in a case which I attended along

with the late Dr. John Taylor of this city, and in which I drew off the urine with the catheter at the first, and subsequently, until the man's death, there was not even a tinge of blood in the urine, and yet the bladder had been fairly transfixed by a portion of the fractured pelvis.

It has been proposed that, when the urine is effused into the peritoneal sac, the recto-vesical cul-de-sac of the peritoneum should be punctured by means of Pouteau's trocar, as it is supposed that the urine will naturally gravitate in that direction ; but in reality, the urine is effused amongst the viscera ; and in the post-mortem examinations I have witnessed of patients who have died from such injuries, I have never seen any such amount of fluid in the inferior cul-de-sac of the peritoneum as would afford an indication for puncturing it. Beyond using the catheter, and treating the general symptoms, I fear we can do but little in these almost hopeless cases. (See case of ruptured bladder in Clinical Cases.)

In approaching the consideration of *STONE IN THE BLADDER*, I need hardly seek to impress you with the importance of the subject, for there is no disease, either medical or surgical, the treatment of which has attracted so much general attention. All kinds of secret medicinal agents have from time to time been vaunted as solvents of the offensive body, and a British parliament, with a view to benefit the public, once voted a large sum to purchase the secret of one of these, the efficacy of which was strongly vouched for. The wonderful remedy turned out to be lime-water ! Whatever use may result from medicines used internally in preventing the formation of stone, or correcting the conditions in the digestive functions which lead to its formation, or in allaying the symptoms, I fear that when a stone is formed we must trust to surgical procedure for its removal. Injection of fluid solvents into the bladder has been proposed and tried, but an acid or alkaline solution sufficiently powerful to act energetically on the calculus would be still more likely to act detrimentally, if not destructively, on the coats of the bladder ;

indeed, even frequent injection of the bladder with simple tepid water is not very safe. A time may come when medical therapeutics may achieve a triumphant solution at once of this difficult problem and of the stone; meanwhile, it is to the surgeon that the patient afflicted with stone in the bladder must look for aid and permanent relief.

In considering this important disease and its treatment, however, the surgeon must not limit himself to the mere local condition, and the methods of operating necessary for its cure. He must equally with the physician examine into the probable causes of the origin of the disease, both as a subject of pathological interest and as indicative in many cases of constitutional tendencies, requiring his attention either before or after his operations, and in deciding him as to the plan of operation he may adopt. But this is not the proper place to enter on the chemical composition and tests for the different forms of urinary calculi; nor, except incidentally and in the briefest manner, can I enter on the physiological conditions which, under certain circumstances, may lead to the formation of stone.

The formation of urinary calculi is now generally admitted to depend on some derangement of the primary or secondary digestion—a portion of the products of digestion being deposited in the kidney or bladder in the form of urates, phosphates, or oxalates. The disease seems to be endemic in some localities and is sometimes referred to the nature of the water drunk by the patients. In the neighbourhood of limestone, for example, there is a tendency to earthy deposits in the urine, either directly, or more usually owing to derangement of the digestion, leading secondarily to the formation of calcareous deposit. In Great Britain, calculous disease is very frequent in Norfolk and in the north and north-east of Scotland, while in other districts it is comparatively rare, though occasionally met with everywhere. In India it is exceedingly common, especially in the north-west upper provinces of Bengal. In the Madras Presidency it is not so frequent, and yet there the operation has been long practised by the natives. In those departments of this country

in which it is most common, I think we shall find evidence of some common cause leading to derangement of the digestive organs, as, for example, in the food not being very digestible ; while in other parts of the country, where the diet is different, the disease is more rare.

There are four different forms of urinary calculi generally recognised, but we must keep in mind that a urinary calculus very generally consists of strata of different salts.

The *Lithic* or *Uric Acid* deposits are far the most common either as gravel or stone. Uric acid calculi vary in colour from a reddish orange to a dark brown colour, are hard and consistent, sometimes rough on their surface, at other times quite smooth and frequently of large size.

The *White Salts*—phosphates of lime, and the triple ammonio-magnesian phosphate—form calculi, white, very friable, and often of large size. Oxalate of lime forms the “mulberry” calculus. Cystic oxide, which is an exceedingly rare calculus, is of a pale yellowish tinge and rather firm consistence. There are certain points to be attended to as regards these different kinds of urinary calculi, with reference chiefly to the prognosis of the disease, and the probability of a favourable result after operation.

When the calculus consists of pure phosphate of lime, or of the triple phosphate, the prognosis is not, as a rule, very favourable. This form of stone occurs in old people, or in those whose general health and nervous system have been much shattered, and where there is a large elimination of the phosphates from the system. This generally indicates an unfavourable condition of the patient, but at the same time we must look to all the circumstances of the case. It is very common for example to find the main body of the stone composed of uric acid, while outside there is a layer of phosphates, deposited in consequence of the chronic inflammation of the bladder, and from the urine being at times phosphatic. But when the whole body of the stone is composed of phosphates the prognosis is unfavourable, because phosphaturia generally shows a great

deterioration of the general health, and especially of the nervous system, and when this occurs in young persons the prognosis is still more unfavourable, for in them there is not the same natural tendency to the deposition of phosphates that there is in the old. In the young, when there is great irritability and much pain, with alkaline urine, the chances of a successful result after lithotomy are doubtful. Even after the operation in some instances we find the margins of the wound coated by the white salts, showing the tendency to the deposition of phosphates from the urine. The phosphatic calculi may form originally in the prostate, and then they do not indicate any constitutional disturbance, but depend on the nature of the prostatic secretion, and consequently are not necessarily unfavourable cases for operation.

The oxalate of lime, or mulberry calculus, is excessively hard and dense, of a very dark brown colour, and presents a peculiar nodulated appearance. It derives its name from its form and colour. When present it causes great pain in the bladder from two causes, first, from the rough irregular surface of the stone, and also, even when the sharp points are not present and the surface is quite smooth, from the sensitiveness of the nervous system present in oxaluria. In some instances the mulberry calculus attains a large size, but most generally, owing to the intense pain it occasions, the patients apply for relief before it has become so large as other forms of stone.

In the uric acid calculus we find the stone composed of different strata. It is occasionally coated with phosphates and urate of ammonia. The phosphate of lime calculi are excessively brittle, even though the nucleus be composed of uric acid.

A calculus may attain a very large size, and may be of almost any form. A patient suffering intense pain from stone in the bladder may, under some remedy such as lime water, be completely relieved for a time, and think he is cured of the stone; but the real state of matters is, that the patient was suffering from a uric acid or mulberry calculus with rough surface, which was the cause of the intense pain at first. Owing

to the irritation of the bladder, the tendency to the deposition of phosphates had perhaps already begun, and this would be increased by the action of the lime water. The deposition of the phosphates would round off the rough surface of the calculus, and make it smooth, and its presence comparatively or altogether painless. This shows that we should not be sure of a stone having disappeared under the action of internal remedies, for the improvement in the symptoms is in general due to such causes, and only temporary.

The symptoms of stone are very analogous to those of an irritable bladder. There is pain in making water, with a frequent desire to micturate. The stream sometimes stops suddenly from spasm produced by the presence of the stone, or from the calculus falling over the orifice of the bladder, and after a pause begins to flow again, either spontaneously or when the patient alters his position. Occasionally the patient suffers intense pain while making water in the ordinary position, which passes off on changing his posture. The stone in the first instance has been resting on the most sensitive part of the bladder—viz. between the orifice of the ureters and the base of the prostate, and the relief is caused by the stone falling from off this sensitive part when the patient changes his posture, the water then passing more readily and with much less pain. There is pain after making water, generally intense suffering if the stone be rough and irregular, owing to the bladder contracting on the stone. In most cases the patient strains very much in passing water, and a little mucus and blood are expelled with the last drops of urine. In young patients the prepuce is generally very much elongated. This arises from the irritation produced by the stone—the pain is referred to the glans penis or orifice, and the patient grasps the glans, dragging the prepuce forwards while making water, so as to benumb the pain, and this causes the great elongation of the prepuce. In the adult, also, the glans penis is very often compressed and irritable, from the patient pressing on it to relieve the pain while making water.

These are the general symptoms of stone, but they may be

simulated by those of some other diseases. In irritable bladder, and chronic or acute cystitis, many of the symptoms are identical with those of stone; there is a constant desire to pass water, with pain in doing so from the violent contraction of the muscular fibres, and from the irritable state of the mucous membrane of the bladder; and sometimes, from the irritation and spasm, the stream of water is arrested for a little, and then goes on again. In disease of the prostate, also, there is a similar condition, but both in this and in irritable bladder, the pain, as a general rule, is greatest before and whilst making water, and relieved after the bladder is emptied; if there is any pain after making water, it gradually passes off, while in stone the pain is, as already explained, most intense after the bladder is emptied.

It is not always easy to diagnose disease of the prostate from stone in the bladder. In cases of enlargement of the third lobe of the prostate, when that projection is incrustated with earthy matter, the irritation thus produced is almost identical with that caused by a calculus, as the lobe is somewhat pendulous, and in some cases forms a valvular projection; there are, in fact, physical causes in operation similar to those which give rise to the symptoms in cases of stone in the bladder. Even in sounding there is a difficulty in diagnosis, for we feel the sound rubbing against the earthy matter on the prostate, which communicates a sensation like that produced by the rub of the sound on a calculus, and in the case of the pendulous projection we can pass the sound above and under it. In children the presence of ascarides in the rectum may very closely simulate the symptoms of stone. I have in several cases seen all the symptoms of stone present when no stone really existed, but they disappeared when the ascarides were removed from the rectum—hence in any doubtful case we should, especially in children, examine the state of the lower bowel.

The pain is not always in proportion to the irregularities on the surface of the stone, for we have sometimes a smooth surface accompanied by symptoms as severe as those produced by mulberry calculus. This is due more to the deranged nervous

condition which gives rise to the disease than to the actual degree of local irritation.

The symptoms in diseases of the kidney, especially in some cases of albuminuria, when this is combined with scrofulous disease of the prostate in boys, are exceedingly like calculus. All the symptoms of stone may be present, and depend entirely on the above causes ; the general health, however, in these cases very soon gives way. The only sure diagnostic for stone in the bladder is the use of the sound, and the method of doing this will be fully considered by and by.

In all urinary affections we ought to be very particular in examining into the general symptoms of the patient, the state of the pulse, and digestive organs, and especially the condition of the urine. When there is any reason to suspect a tendency to the deposition of phosphates, or that the urine is albuminous, the urine should be examined repeatedly. When a little of the urine is heated, if there be any phosphates in it it becomes opaque and muddy, but, on adding a drop or two of nitric acid, it at once becomes clear again, with perhaps some slight effervescence ; the phosphates are decomposed by the acid and dissolved. If albumen be present, the addition of nitric acid will only make the urine more opaque than it was after being heated. When pus is present the tests of heat and nitric acid give results somewhat similar to those of albumen ; but if, instead of nitric acid, we add a few drops of liquor potassæ to the opaque urine, the pus becomes dissolved and the fluid clears. When both albumen and phosphates are present in the urine, and if this condition be persistent, the case is a very unfavourable one ; still in many of these cases we must allow for a certain amount of fibrinous matter, the result of irritation of the organs, causing the albuminous deposit, and then the average specific gravity of the urine must be carefully ascertained. When the phosphates are very largely present, and when the general state of the patient indicates debility or nervous exhaustion, though that should not absolutely prevent us from operating, still the prognosis is unfavourable, especially when the patient is young. In phosphate of

lime calculi the condition is generally due to prostatic calculi, and the prognosis is not necessarily so unfavourable. The oxalate of lime or mulberry calculus is not unfavourable for operation, but after its removal the use of nitro-muriatic acid and other tonics is required. Cases of uric acid calculi are generally favourable as regards the prognosis, and there is seldom anything to contra-indicate the operation after the presence of the stone has been ascertained.

LECTURE CXVII.

Operations for the Removal of Vesical Calculi—Lithotrity and Lithotomy: the Cases most suitable for these Operations—Preliminary Exploration of the Bladder, or Sounding—Lithotrity.

THERE are two great methods of getting rid of stone in the bladder, *Lithotomy* and *Lithotrity*, each method being more suitable for certain cases than for others. When lithotrity can be performed in cases where everything is favourable for it, there is no doubt that the operation is one attended with less risk to life than lithotomy; but then, unfortunately, it happens that the cases suitable for lithotrity are comparatively rare. In private practice, among the better class of patients, lithotrity can be performed much more frequently than in hospital practice; for in the former the patient generally applies to a surgeon early, whilst the stone is still small and friable, and before its presence has excited chronic vesical irritation, and when it can therefore be crushed under the most favourable circumstances. But there are certain conditions which must be attended to in deciding which is the preferable operation in each individual case. What then are the conditions favourable for the performance of lithotrity? First, the stone must be of a small size, or at all events not large; it must also be of a somewhat friable composition, and likely to yield readily to the crushing instrument introduced into the bladder *per urethram*, because the force we can employ is limited by the size of the canal. The stone should be friable in a particular way. It should break up readily into small fragments or sand. The oxalate of lime calculus is not friable in this way; it breaks up into a number of small sharp fragments, which are not easily broken up completely, and these sometimes get impacted in the urethra, and cause a great deal of trouble and danger; hence

mulberry calculi are not cases in which lithotrity should, as a general rule, be employed. The kinds of stone best suited for this operation are the uric acid in its early formation, and the phosphatic calculi. These latter calculi are very readily broken up and crushed to powder, and after the earlier sittings, by injecting the bladder, portions of the stone may be dissolved and brought away, so that in many respects the phosphatic and soft uric acid calculi are the most favourable, and the oxalate of lime the most unfavourable for the operation of lithotrity. Where two or more calculi exist, lithotrity is not so advantageous, as the different calculi are caught and partially crushed at the different operations, and hence there is a want of certainty as to the result.

The condition of the urinary organs should be attended to in choosing either operation. For lithotrity the bladder must be sufficiently capacious to retain a moderate amount of fluid, say from five to eight ounces. When the patient has suffered from stone for a long time, or when he is constantly making water, the muscular coats of the bladder get thickened and irritable, and the capacity of the cavity is diminished, so that it is unable to contain even a moderate quantity of water. The opponents of lithotrity used to argue that the operation could very seldom be performed on this account. We can, however, obviate this difficulty by injecting a little tepid water occasionally into the bladder, and so gradually increasing its capacity, and accustoming it to contain some bland unirritating fluid. If we can by such treatment get the bladder to contain say from five to eight ounces of water, we are quite justified in performing lithotrity, provided all the other conditions are suited for it.

The most important point, however, is the size of the canal of the urethra; it must be of such a size as to allow a full-sized lithotrite to enter the bladder. We must have an instrument of full crushing power, and therefore the urethra must be tolerably large to allow of the passage of the instrument. It must also be large for another reason—to allow the fragments of the stone to come away readily. If the urethra be small, they will probably

become impacted in the canal, and give rise to much trouble, or even danger. It is obvious, therefore, that lithotrity is not an operation suitable for boys, for in them the urethra is neither large enough to allow of the passage of a full-sized instrument, nor to allow the larger broken fragments to come away readily with the urine; besides, in children, the bladder is generally very irritable in cases of stone. In children, moreover, the lateral operation of lithotomy is almost unattended with danger, while the irritation caused by the use of the lithotrite is very great. I consider that lithotrity ought, therefore, never to be performed in children. When the prostate is enlarged and dense, as in old people, lithotomy is not so favourable, for in such cases we require to cut very freely, and split up the resistant gland; and though there is little risk of infiltration of urine, and the operation itself is easy enough, and though the patient goes on very well for some time, even for weeks after the operation, yet we sometimes find that at a later period gastric and hepatic irritation set in, dysentery comes on, and the patient ultimately sinks. The wound itself may have healed, but it is the effect of the operation that has killed the patient; and therefore in this class of cases I prefer lithotrity if the stone be small and easily broken, and if the prostate be not of such a form as to present a valvular obstruction to the passage of the fragments of the stone. In these cases we can introduce a full-sized instrument, and by proper medical treatment get over the irritable state of the bladder, and thus there is every chance of a successful result after lithotrity, more especially as the calculi are generally phosphatic.

In the female we do not often require to operate for stone, because, from the shortness and straight course of the female urethra, calculi readily pass out of the bladder by the urethra if they are of a moderate size, and hence they do not often attain any great size in the female; but, when they do, they give rise to intense suffering, and require some operation for their removal. If we perform lithotomy in these cases, or instead of this use mechanical dilatation, such as the sponge or tangle tent, or special

dilating instruments, we can extract the stone readily enough by forceps ; but then the patient is sometimes left in a very pitiable condition from the permanent incontinence of urine which results from the cutting or dilatation. Lithotrity has everything to recommend it in the case of females ; in them the urethra is wide, short, and straight, and we can therefore introduce an instrument of great crushing power into the bladder, easily seize and act upon the stone, and there is a direct and free outlet for the crushed fragments of stone. For these reasons, I hold that in females lithotrity is far preferable to extreme dilatation or lithotomy when the stone is so large as to require any surgical interference.

In the adult male, however, when the stone is tolerably large and the patient is otherwise healthy, with no great enlargement or hardness of the prostate, and when several sittings would be required before the stone could be thoroughly crushed by lithotrity, I think that lithotomy is generally the preferable operation. There is no great danger attendant on lithotomy if it be properly performed ; and I would therefore limit lithotrity in the healthy adult male to those cases in which the stone is small and easily friable, and the bladder not excessively irritable, or to cases of enlarged or rigid prostate.

Before proceeding to demonstrate the method of performing lithotrity or lithotomy, I must first describe the preparatory exploration of the bladder with the sound, which, as I formerly stated, is the only positive diagnostic of the presence of a stone. This preliminary operation, though simple, requires certain precautions, and must be proceeded with methodically, so as to make sure of detecting a stone if present ; and also to ascertain, approximately at least, the bulk and general character of the calculus. Whilst doing this, the size of the prostate and its consistence should be examined, so that we may, if possible, avoid any unnecessary explorations prior to the operation. Before proceeding to sound the patient, the bowels should be cleared out, and the rectum emptied by an enema. If the bladder be not very irritable, the patient should be made to

retain his urine for an hour or so before the examination. If, however, the patient is unable to retain his water, then we must inject some tepid water into the bladder. This requires to be done very gently, by means of a slow continuous stream, avoiding all jerking, pausing occasionally to give time for the muscular coat to dilate gradually. About six or seven ounces of water are quite sufficient to enable us to explore the bladder fully.

The form of sound to be used is of some importance, for, with a sound with the curve of the ordinary catheter, we cannot move the instrument freely in the bladder, and might readily pass over a flat stone lying in the pouch behind the prostate—a position the stone often occupies—and this will be more likely to occur in old persons, or in patients in whom the gland is enlarged. For these reasons, the sound is generally made with a short and

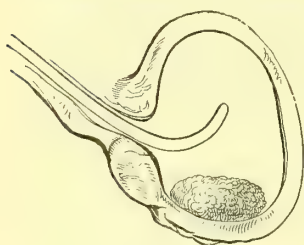


Fig. 40.

rather sudden curve, so as to enable us to turn the point in all directions, and sweep the whole cavity of the bladder. Of late years I have generally used a sound with the end made of the same form as the closed lithotrite, but the stalk much smaller—about No. 7 or 8 gauge—to enable it to lie loose and move easily in the urethra. I first used this to prepare the urethra for the lithotrite; but I found it so easily moved in the bladder, and give rise to so much less pain than the ordinary sound, that I now use it in almost all cases in the adult.

In many instances the closed scoop lithotrite answers very well to sound with, and has moreover this advantage, that it enables the surgeon to measure the bulk of the stone, by seizing it between the blades. In all cases, however, we should have at hand sounds of different curves, and a short pointed catheter. This last-mentioned instrument is sometimes needed, not only to enable us to inject water into the bladder, but also in cases where the detection of the stone is difficult. By using the catheter, and allowing the urine to escape

slowly, it often happens that, as the bladder contracts, the stone is brought into contact with the instrument, which can then be used as a sound. Whilst I consider the short-pointed sound as most suitable for complete exploration, I cannot help noticing a circumstance which has often struck me—viz. that in cases even where there had been some difficulty at first in detecting the stone by the sound, I never knew an instance in which the staff, when introduced for the purpose of performing lithotomy, did not, almost at once, strike the stone, though, from its long point and larger curve, it seems the most unlikely form of instrument for the purpose.

In proceeding to explore with the sound, the preparations already mentioned having been attended to, the patient should be placed recumbent, with a pillow placed under the hips to elevate the pelvis. The surgeon, standing on the left side of the patient, introduces the sound, previously warmed and oiled, into the urethra. If the oval-pointed sound or the lithotrite be used for exploration, the large extremity must be introduced, so as to present its flattened surfaces to the sides of the orifice, to suit its long axis—not transversely, which would over-distend the opening. The instrument is then carried onwards, with the extremity bearing gently towards the right side and upper surface of the urethra, until it reaches the opening in the triangular ligament; the penis is then drawn gently forwards on the sound, whilst at the same time the operator depresses the handle of the instrument, to make it take the turn of the canal, and pushes it onwards till he feels it enter the bladder.

In depressing and passing home the sound, no force should be used, merely the gentle pressure of one or two fingers on the upper surface of the handle will suffice; and when the lithotrite is used, the weight of the handle of the instrument requires only the finger to guide and give it direction.

When the sound has entered the bladder, it may possibly strike the stone at once; but still we require to ascertain its bulk, and whether it is movable, and other conditions. The surgeon waits for a minute or two, and then proceeds to

move the sound with great care and lightness over the interior of the bladder. If the patient has been placed as directed, the instrument naturally glides down the inclined plane from the prostatic part of the urethra, over the trigone, towards the posterior fundus of the bladder, and, as the stone has most likely fallen back in that direction, it may strike it at once. If it does not, the curved extremity should, by merely rotating the handle, be moved first to one side and then to the other. If this manœuvre does not succeed in detecting the calculus, then the sound is made to sweep round the whole surface, and, as it is withdrawn to near the neck of the bladder, the concavity of its curve is turned backwards, so that the point may search the sac-like part of the "bas fond" of the bladder, which exists when there is an enlargement of the prostate. If not felt there, the concavity is turned forwards, in case the stone be resting on the pubis, a position it sometimes occupies, although this is not likely to be the case when the patient is recumbent.

Should nothing be felt, the patient is then brought into the erect position, and the catheter may be used to empty the bladder gradually, when the stone, if there be one, will probably be brought in contact with the instrument. It is advisable, however, to avoid introducing many different instruments; and, if the form of sound I have described, or the scoop lithotrite be used, if the handle be a little depressed, so that the large extremity is removed from the neck of the bladder, the patient in most cases can pass water by the side of the instrument, and there is therefore no use in introducing the catheter, and irritation is thus avoided. When the calculus is touched, the surgeon passes the end of the sound over its surface, so as to gain some idea of its length and breadth; next, he passes the point by the side of the stone to measure its thickness; and then, passing the sound under it, he determines its mobility, and at the same time gains some notion of its weight. The knowledge so gained, however, is very imperfect, as you may easily conceive. If, however, the lithotrite be used as a sound, then, when the foreign

body is felt, the surgeon, by opening the blades widely, and gradually closing them, will generally get the calculus between the blades, and will thus be able to form a pretty accurate idea of its bulk. Of course he must examine it in different positions, for a small stone caught in its largest axis would give an erroneous idea of its bulk. The grasp of the lithotrite also serves to indicate, in some degree, its character of hardness or softness.

In cases where, after careful exploration, gently carried out as just described, we cannot detect a stone, we should desist, use means to allay the irritation of the bladder, and after a few days, examine again, using an instrument of a different form, should that be thought advisable.

In sounding, care must be taken to avoid being deceived as to the sound touching a stone. I have known the surgeon and those present momentarily deceived by the sound produced by the handle of the instrument striking a ring on the operator's finger, and not unfrequently, in disease of the third lobe of the prostate, the projecting part is covered with earthy sabulous matter, and the same earthy deposit may take place on the projecting rugæ, caused by the hypertrophied muscular coat of the bladder. We must never be satisfied by feeling a mere rub, but should make quite sure of the presence and mobility of the concretion felt.

Having thus described the process of exploring the bladder to ascertain the presence of a stone, I now proceed to describe the different operations for the purpose of crushing or extracting it, and begin with LITHOTRITY.

In describing the method of performing lithotrity, I have no intention of describing or discussing the merits or the mechanism of the different forms of lithotrites now used ; for that information I would refer you to the works of Sir William Fergusson, who has done so much to simplify and improve the instrument, and to the monograph of Sir Henry Thomson. The instrument which I show you is that usually known as Sir Henry Thomson's Lithotrite, and, for ordinary practice, you re-

quire two of these—one powerful, and having the end of the female blade fenestrated ; the other the scoop lithotrite, in which the flattened end is hollowed to receive the end of the male blade, but not fenestrated. The former of these instruments is intended for crushing the stone in the first operation, and is fenestrated to permit the larger fragments to be thrown out from between the blades, and should be very powerful and cut from the solid metal. The other is used in the after sittings, to reduce the fragments to sand, and hence no opening is made in the end of the female blade. Both instruments act on the same principle, and have two movements. As I use it now, you will observe it acts with a sliding movement, so that I can readily open and close the blades, and use a certain amount of percussion, by pressing on the handle of the lithotrite with the ball of my thumb ; but when with the point of my thumb I draw up the small button-slide towards the handle, I at once convert the movement into the powerful screw action ; and this again can be altered by pushing down the slide. This form of lithotrite, therefore, enables the surgeon to use it with great facility.

The preliminary arrangements for, and the earlier steps in the operation of lithotrity, are so similar to or identical with those of sounding just described, that I shall only briefly recapitulate them here.

The patient should have the lower part of the bowels cleared by an enema about an hour and a half before the operation, and should be told to retain his urine. Should his bladder be too irritable to retain a sufficient quantity of urine, the surgeon must in that case inject six or seven ounces of tepid water into the bladder, using the precautions I mentioned when speaking of sounding. The patient should be placed on a firm table, lying on his back, his head moderately raised, and a pillow placed under his hips, to elevate the pelvis, and favour the calculus falling backwards. In using the sound or lithotrite, I prefer to stand on the left side of the patient, and then, having warmed and thoroughly oiled the fenestrated lithotrite, I introduce the broad flattened beak of

the instrument sidewise, so as to correspond to the long axis of the urethral orifice. I then glide it downwards, bearing gently towards the right side and upper surface of the canal, and gradually bringing it away from the abdomen. On reaching near the sinus of the bulb, I draw forwards the penis gently on the instrument, and depress its handle, to make it take the turn and enter the membranous and prostatic portions of the urethra. Then, keeping the instrument in this position, with the pressure of a single finger on the extremity of the handle, it is gently pushed along the prostatic urethra, and enters the bladder. In passing the lithotrite, no force is permissible or necessary. When the lithotrite has entered the bladder, the surgeon pauses for a moment, and then begins to search for the stone. In the position in which the patient has been placed, it is probable, that as the instrument glides backwards it may strike the stone at once. If it does not, the closed lithotrite is gently withdrawn towards the neck of the bladder, and then, by turning the handle, the beak of the instrument is made to turn first to the right and then to the left side, to feel if the calculus be there; or its point is turned backwards behind the prostate in case the stone be lying close behind the gland. If not found in any of these positions, the patient should be slightly moved to try to change its position, and the lithotrite swept gently round the bladder. Some recommend that the blades of the lithotrite should be opened pretty widely and depressed, and then closed, to try to catch the stone. I have occasionally succeeded in doing this when I could not detect the calculus with the closed lithotrite, but it seems to me an uncertain proceeding, and one not to be generally recommended. Other operators recommend pressing the end of the lithotrite back towards the posterior fundus of the bladder, so as to make a depression, and then to open the blades to allow the calculus to fall into it. Various other methods have been proposed, and perhaps that of Civiale is the best. Having felt the stone with the lithotrite, he turns the beak towards the opposite side of the bladder, and opens the blades widely, then turning them over to the side where the stone lay.

he gradually closes them on it. The stone being caught and carefully secured between the blades of the lithotrite, the operator now gently depresses the handle, so as to raise the instrument and stone from the posterior fundus of the bladder, and bring them into the centre of its cavity, away from its walls.

He grasps firmly the handle of the lithotrite with his left hand, glides the button of the catch upwards by a touch of the

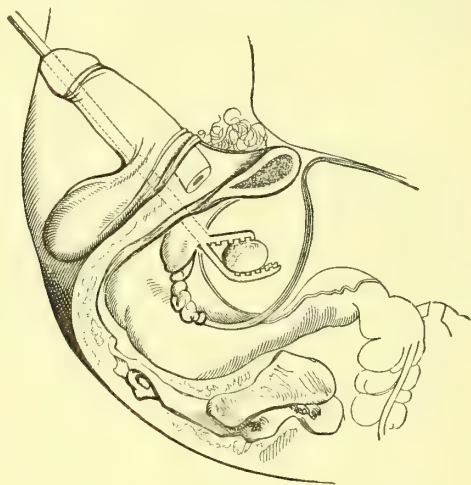


Fig. 41.

thumb of his right hand, and so converts the sliding into the screw action. With a gentle turn of the screw he fixes the stone firmly, and then, by half-turns of the screw, he exercises at first a sort of percussion force on the stone, till he feels it begin to yield, and, by the more forcible screw movement, he gradually crushes the calculus. When the fragments are felt to separate and fall out of the lithotrite, the surgeon should screw the blades fairly home.

He now, by pushing down the catch, resumes the sliding action of the instrument, turns its beak, laterally depresses it, and separates the blades, so as to enclose any large fragment, which he crushes either by simple pressure of the blades or by reverting to the screw if necessary. This may be repeated on

one or two fragments, but great caution is required, to avoid doing too much at the first sitting.

After the operation the patient should lie on his back, and an opiate suppository should be administered, to obviate irritation and prevent the patient straining to make water. In passing water he must not be allowed to stand up or kneel, as by so doing sharp fragments may be forced into and become impacted in the urethra, lacerating it, and giving rise to great danger. He should pass his urine lying on the back or side, and the urine should be kept in a glass vessel to permit the detritus to subside. Very little of the debris of the calculus passes during the first twenty-four hours ; but, if the patient drinks freely of diluents, the fragments become water-worn and rounded, and then pass more readily when the patient makes water. No second examination or operation should be had recourse to for at least four or five days. More generally, a week should elapse, and then we should only interfere if all irritation from the first operation has ceased. On the occasion of the second sitting, as it is termed, we should use the scoop instead of the fenestrated lithotrite, our object now being to crush any broken fragments into sand.

In the first and second operations it is not desirable to wash out fragments by injecting the bladder ; but afterwards, when we feel sure that only some moderately small fragments remain, we may proceed to wash out the bladder by means of Clover's apparatus, which consists of a large catheter, with the eye in the concavity near its point fitted to an india-rubber bottle, with an intermediate glass reservoir into which the detritus falls.

The forcible impaction of a sharp fragment of stone after the first crushing is a serious danger, and various forms of forceps have been proposed for extracting such fragments. If it has been forced very near the external orifice, there can be no great difficulty in getting it out by gently pressing it forwards to the orifice, which may, if necessary, be dilated or cut. When the fragment is placed far back, attempts to use forceps would only,

in my opinion, add to the mischief. The safest plan, in such cases, is to push back the fragment into the bladder by gentle pressure with a full-sized catheter, or by a stream of tepid water injected into the urethra. Should the fragment be large and firmly impacted near the sinus of the bulb, I consider that an incision in the middle line of the perineum would be safer practice than attempting its removal by urethral forceps, however ingeniously devised for the purpose. In extreme cases, where one or more fragments have become impacted in the prostatic or membranous portions of the urethra, the mesial or lateral operation of lithotomy should be performed. Such cases, however, must be of very rare occurrence if ordinary precautions are observed.

LECTURE CXVIII.

Lithotomy—Supra-pubic, or High Operation—its Dangers, and Proposals for diminishing them—Steps of the Operation—After-Treatment—Sub-pubic or Perineal Lithotomy—Different Methods—Anatomy of the Male Perineum with reference to Lithotomy.

I SHALL now describe to you as succinctly as I can the principal methods of performing LITHOTOMY, or the operation of cutting for stone.

The methods of performing the operation of lithotomy may be first classified under two great divisions—SUPRA-PUBIC and PERINEAL LITHOTOMY. The former, or High Operation, is never now performed except as an operation of necessity. In cases where there is any deformity in the bones of the outlet of the pelvis, or where the stone is excessively large, so that it cannot be extracted through the lower outlet of the pelvis, the high or supra-pubic operation is the only means of relieving the patient. It has, however, been proposed in such cases, rather to cut into the bladder by the lateral operation, and introduce a powerful crushing instrument, so as to break up the stone in the bladder when it is so large that it cannot be extracted in the usual way.

The supra-pubic operation has this great disadvantage, that, whenever the bladder is opened, it subsides behind the pubis, and the urine tends to infiltrate into the loose sub-peritoneal cellular tissue of the pelvis. To obviate this a variety of methods have been proposed. Some recommend an incision to be made in the perineum opening into the membranous portion of the urethra, and a tube or catheter introduced into the bladder, to give a free dependent opening for the urine to escape, and so prevent, or at least diminish

the risk of urinary infiltration. Others recommend cutting down on the bladder and exposing it; then, some forty-eight hours afterwards, opening it and extracting the stone. But, to say nothing of two operations, the objection to this latter plan is obvious—the patient could not contain his water for forty-eight hours; and, therefore, the bladder would shift its position slightly in the interval between the two operations. When the supra-pubic operation is really required, I believe that the best plan is simply to cut into the bladder above the pubes, with the proper precautions, and extract the stone; and afterwards to introduce, by the urethra, a flexible or vulcanised india-rubber catheter, and keep it constantly in, to allow the urine to flow off by the natural passage, and so prevent, or at least lessen the risk of infiltration. Still further, by placing the patient on his side, and introducing a long narrow strip of gutta-percha tissue, previously varnished, into the wound of the bladder, and allowing the end to hang out over the side of the incision, the overflow of urine will pass along it. This may be still further assisted by means of tepid water constantly dripping into the wound from an irrigating apparatus, should that be thought necessary; but I confess I have but little faith in such irrigation. I have seen one case of the high operation under treatment on the Continent, where the patient, a boy, was lying with the lower part of his body immersed in a tepid bath, and had been kept in it for some days. He seemed to be very comfortable. The principle of the operation is founded on the varying position of the bladder, and its relation to the peritoneum in different states of the viscus. When distended, the bladder rises above the pubis, and gradually throws upwards the fold of the peritoneum, which, in its contracted state, lies upon it. As it becomes very fully distended, the peritoneum is thrown off its anterior surface altogether, so that, by cutting down upon it in the mesial line above the pubis, we can open into the bladder without wounding the peritoneum. The bladder, therefore, requires to be very fully distended, or injected with water, before operating, so that it may occupy the proper position. Some recommend that a large

catheter should be passed along the urethra, and the bladder projected before it, so as to form a guide to its position ; but this is never a safe method.

The bladder having been felt distended above the pubis, the HIGH OPERATION is performed as follows. The surgeon makes an incision about two and a half or three inches long in the mesial line of the abdomen at its lowest part, immediately above, or even partly over the pubis. This first incision divides the skin and fat, and exposes the lowest part of the linea alba, which is next divided between the pyramidal muscles. The edges of these muscles and of the wound should be gently held, not dragged, aside by copper spatulæ. The knife should now, if at all, be very sparingly used. With his finger the operator separates the loose connective tissue, and recognises the anterior surface of the bladder, and, if possible, ascertains the position of the reflected peritoneum. He then feels for the distended bladder, and pushes his knife into it about an inch and a half above the pubis, with the edge directed downwards, and cuts towards the pubis, then hooking his finger in the opening so made, he draws forward the bladder, and, guarding the peritoneum, enlarges the opening. There is no necessity, however, for making a very long cut through the coats of the bladder, for the divided muscular coat readily yields, so as to allow the easy extraction of a very large calculus. The introduction of forceps and the extraction of the stone are not attended with any of the difficulties which are occasionally met with in perineal lithotomy.

The operation is unattended by any risk of hæmorrhage, and, as regards its manual procedure, is very simple ; but unless the precautions I have described be attended to, the sac of the peritoneum may be opened, and the intestines escape ; and when I mention that this accident actually happened in the hands of so dexterous a surgeon as Baron Dupuytren, you will see the necessity for care. The after-treatment is to be conducted on the principles already laid down when speaking of the dangers of this method, and the means of diminishing or obviating them.

All the methods of performing SUB-PUBIC or PERINEAL LITHOTOMY have for their object the extraction of the stone, by incisions, through the parts closing the inferior outlet of the pelvis. This outlet or space in which the incisions must be made is limited by osseous and ligamentous boundaries, and by the relations of the great pudic artery, and some of its branches, which, at certain points, lie close to the lines of incision of some of the methods. Deeply, towards the pelvis, the extent and direction of the incisions of the prostate are limited by the connections of the pelvic fascia ; whilst posteriorly the widest part of the outlet is largely occupied by the lower part of the rectum.

As regards perineal lithotomy, the problem to be solved is, to obtain an opening from the perineum into the bladder of sufficient size to admit of the easy extraction of the stone, without passing beyond the limits of the prostate gland and its fascial coverings, with the least risk to the pudic artery or its branches, and without injury of the rectum. In the recto-vesical method the last consideration is of course disregarded, as wound of the rectum forms in it a part of the operative procedure.

Lithotomy by any of the perineal methods is an operation which, although in many cases simple and easy of performance, is in other instances attended with great difficulties, requiring all the skill, dexterity, and determination of the most experienced to overcome. Such difficult cases the surgeon who undertakes the operation must be prepared to meet, and, like every other surgical operation, it especially requires a thorough knowledge of the anatomy of the parts concerned in the operation. Although the modifications of the different methods of perineal lithotomy are almost endless, these methods may be enumerated under four heads—viz. 1st, the lateral operation—that most generally performed ; 2d, the bi-lateral operation ; 3d, the central or median operation ; and 4th, the recto-vesical or median operation, combined with division of the anterior wall of the rectum.

Before you can understand the comparative merits or demerits of these different methods, it is first necessary that I point out

to you the general dangers of lithotomy. Amongst these dangers there are some common to all methods, such as pyæmia, inflammation of the neck of the bladder, uræmia from suppression of urine, and the shock. This last, however, is now much diminished since the introduction of chloroform. These risks do not depend on the method of operation, and, so far as the incisions are concerned, may be termed unavoidable. The dangers incident to certain methods of operating are—hæmorrhage, infiltration of urine into the subperitoneal cellular tissue of the pelvis, and wound of the rectum. The last-mentioned occurrence, however, is rather a disagreeable accident than a danger; and indeed, as I have already stated, free incision of the rectum forms a necessary part of the recto-vesical operation. To these risks must be added the danger of bruising and lacerating the textures at the neck of the bladder and of the perineum, in attempts to extract forcibly a large stone through an insufficient incision.

To understand how far some of the methods give a greater chance than others of avoiding some of these dangers, and how some of them, in trying to avoid one risk incur another equally dangerous, let us take a general view of the space in which any of the forms of perineal lithotomy must be performed, and the relations of the pelvic fascia to the deep incision in reference to the risk of infiltration of urine.

The perineal space, or inferior outlet of the pelvis, is not very large in the male; bounded in front by the pubic arch and subpubic ligament, and laterally by the rami of the pubis and ischium and tuber ischii, and laterally and posteriorly by the great sacro-sciatic ligament overlapped by the margins of the gluteus maximus of each side, and posteriorly by the coccyx. We have a diamond or lozenge-shaped space, which, for the sake of description, may be divided into two nearly equal triangles by a line drawn across the space from one tuberosity of the ischium to the other. The anterior is sometimes termed the urethral triangle, and corresponds more directly to the membranous and prostatic portions of the urethra and the neck of the bladder, the parts towards which our incisions in lithotomy are directed.

The posterior or anal region of the perineum, the anterior part of which is implicated in the lateral and bilateral methods of lithotomy, is occupied in the centre, and to some extent laterally, by the anus and the lower pouch of the rectum, on either side of which we find the ischio-rectal fossæ, containing a quantity of fat and loose cellular tissue and the inferior hæmorrhoidal arteries and veins.

The widest part of the space, in reference to lithotomy, is between the tuberosities of the ischium. The measurement here is very variable. Dupuytren and Velpeau give its dimensions—the former as varying from 2 to $3\frac{1}{4}$, and Velpeau from less than 2 to 4 inches. The general average of my own measurements is rather less than 3 inches. When viewed as in lithotomy, the anterior space is bounded by the scrotum, and in the central line we remark the raised line or raphé, and the fulness caused by the spongy part of the urethra. The space is covered by the skin and common superficial fascia; under this it is closed in by a dense layer of fascia, the true superficial fascia of the perineum. Under it we find the superficial perineal branches of the pudic artery and nerve, the accelerator urinæ muscle covering the bulb and spongy portion of the urethra and part of the surface of the anterior layer of the triangular ligament, and laterally, in close contact with the accelerator anteriorly, is the erector penis covering the crus penis. Posteriorly the transversus perinei muscle crosses the space from the tuberosity of the ischium to the central point of the perineum. If we now draw aside the erector penis, clear away the posterior fibres of the accelerator, and draw down or divide the transversus perinei, we perceive a dense aponeurotic structure. This is the anterior or superficial layer of the triangular ligament, which stretches across and closes the anterior part of the perineum, merely presenting an opening for the urethra. This triangular ligament consists of two layers which coalesce at the posterior boundary of the anterior triangle, but which are elsewhere separated for nearly the depth of 3-4ths of an inch. This interval between the layers is traversed from above downwards and forwards by the mem-

branous portion of the urethra, and is occupied by the muscular fibres of the compressor urethræ, and a plexus of veins, whilst, about 16 lines in front of the anus, the artery of the bulb runs across the space from without inwards, close to the anterior layer of fascia, and immediately below it, and close behind the bulb, the ante-prostatic or Cowper's gland is situated.

If, at this stage of the dissection, we mark a line beginning about an inch and a quarter in front of the anus, close to the raphé, and passing obliquely downwards and outwards about midway between the anus and tuber ischii, we indicate the line of incision in the lateral operation of lithotomy, and we see the parts which must be divided to reach the triangular ligament. If the posterior margin of that fascia be lightly touched with the knife, and the finger entered deeply about the middle of the line of the incision, and directed upwards and to the central line of the perineum, as if to reach the subpubic arch, the groove of the staff will be felt in the membranous part of the urethra, and you will notice that the artery of the bulb lies anteriorly and superficially to the part of the urethra into which the knife should be entered. If, on the contrary, you were to cut the triangular ligament as far forwards as the extent of your external incision, you would be very likely to divide the artery of the bulb. If you now examine the mesial line of the perineum, you will perceive that whilst it is the shortest and most direct route to the neck of the bladder from the perineum, there is only a very short space between the bulb and anus, and that this space diminishes between the bulb and rectum, as we pass upwards. Indeed, in many subjects, the bulb completely overhangs the membranous part of the urethra. At the same time, however, you will observe that no important structures occupy the recto-urethral space, that the rectum can be easily pressed back, and that by dividing the muscles and other textures connected at the central point of the perineum, and by bulging forwards the convexity of the staff, the membranous urethra can be made easily accessible. Still, the mesial incision must necessarily be limited as compared with the lateral,

unless we divide the anterior wall of the rectum, as in the rectovesical operation.

We now remove all the muscular and other structures, leaving merely the posterior layer of the triangular ligament, and we can feel the prostate though we cannot see its form. We therefore dissect away the posterior layer of fascia, and this brings into view the thick anterior fibres of the levator ani descending on the sides of the prostate, and you will notice how these strong fibres will require division to some extent in lithotomy. Cut across the anterior part of the levator, and the contour of the perineal aspect of the prostate, enclosed in its fascial sheath, is seen. We now turn from the perineum to the interior of the pelvis, strip off the peritoneum from the pelvic fascia, and clear away any fat with the handle of the scalpel. You now perceive that a lamina of the visceral layer of the pelvic fascia is reflected on the upper surface of the prostate, and from it upon the sides of the bladder, above that gland, so as to form a septum or barrier, as it were, between the upper and lower part of the pelvis. Looking from the pelvis you can see nothing of the perineal dissection. Looking from the perineum you can see nothing above the prostate; but if you pass the fingers of one hand from the pelvis, and those of the other from the perineum, you feel that they are only separated by this reflected layer of fascia, and you see at once how an opening in the prostate, if made either directly downwards, as in the median operation, or obliquely downwards and outwards, as in the lateral and bilateral methods, if not carried too transversely or too far outwards, beyond the base of the gland, will enable you to open the bladder, and extract a stone, without dividing this important barrier, so that the urine will naturally flow by the perineal incision, and cannot possibly reach the subperitoneal cellular tissue.

I have avoided entering on the complex descriptive anatomy and nomenclature, and all the connections of these fasciæ. I merely content myself with pointing out their relations and bearing on the incisions in lithotomy.

The dimensions, form, and structure of the prostate gland

also demand our special attention, for the direction and the extent to which we can carry our incision through its substances without dividing that part of its base where the reflection of the fascia takes place, forms one of the most important points in regard to lithotomy. The form of the prostate has been well compared to that of a chestnut. It surrounds the commencement of the urethra, at the neck of the bladder. The great portion of the substance of the gland lies posterior to the canal of the urethra, about one-third or one-fourth of its substance lying on the anterior or pubic aspect of the canal. The prostate is placed somewhat obliquely, its apex directed downwards and forwards, whilst its body and base rest upon the rectum, the base as it were embracing the neck of the bladder, and connected with the vas deferens and vesiculæ seminales, whose ducts pass into and through its substance. If we take the measurements of the prostate in different directions, we shall find that in the mesial line, from above downwards, from its base to its apex, it measures from twelve to fourteen lines in the adult, and that its longest axis on each side is from the apex, at the membranous part of the urethra, obliquely downwards and outwards, which gives a difference of from three to four lines more than the mesial measurement; and this direction is also that in which the incision is least likely to injure the reflection of the ileovesical fascia, as it runs lower down and parallel to the line of reflection. Incisions made in similar directions, through both sides of the gland, will of course double the size of the opening in the prostate, and give us the largest aperture we can obtain consistently with the non-division of the base of the gland. But to understand how stones are readily and safely extracted by the ordinary lateral operation, though much larger than we should suppose the opening of the prostate would permit, we must consider the character of its structure. The prostate, in its normal healthy state, is soft and yielding, composed of a congeries of mucous follicles interspersed with a peculiar fibrous structure, which some anatomists consider as muscular, and these textures are enclosed in a very thin but

strong fibrous capsule, which gives the gland its form and compactness. If we examine the gland where it surrounds the neck of the bladder, by dissecting off the mucous membrane from the commencement of the prostatic portion of the urethra, we find that at the opening of the bladder there exists a ring of dense elastic fibrous texture, about three lines in breadth and depth : and even in the dead subject, though the orifice of the urethra into the bladder can be dilated to some extent without incision, it will not yield beyond a certain point unless this dense ring be divided, and then we find that when it is cut the gland texture splits up in the direction of the cut with very slight force ; this dense structure should always be divided in lithotomy, to enable us to enlarge the opening with the finger. When we look at a dissection of the parts after lithotomy has been performed, such as that shown in Plate lv. Fig. 1, it would seem as if the incision of the prostate was limited to the opening at the apex of the gland ; but if you look from the interior of the bladder, as in Fig. 2, Plate lv., you will see that the incision has traversed the whole length of the prostatic urethra, and divided it, together with the elastic fibrous structure—this is indicated by the dotted line in the diagram of the lateral operation. In looking at such a dissection you must, moreover, recollect that the prostate is enveloped in a sort of sac formed by the visceral layer of the pelvic fascia. We have seen that the ileo-vesical layer is reflected upon its base, and from it to the bladder on the side, the prostatic layer covers it and the vesiculæ seminales laterally, whilst between it and the rectum we find the recto-vesical layer of fascia passing across from one side of the pelvis to the opposite. It is this fascial envelope which maintains the form and gives the appearance of a very limited incision ; for, if we remove the parts, and dissect off the fascial covering, as in Fig. 3, Plate lv., you observe that in most cases the limited incision made by the knife has split up under pressure of the finger throughout nearly the whole extent of the substance of the prostate, but leaving the resisting fasciæ entire ; and you will thus understand how a large stone may be easily extracted

through what at first seems a very limited opening. I need hardly remind you, that in old people the prostate alters both in size and structure, and, although its increased bulk enables us to make a larger incision in the gland, its altered indurated structure does not yield as in the healthy gland, and requires to be freely divided with the knife, to enable us to extract the stone. In such cases I can only compare the sensation to that of cutting through a thick mass of India-rubber. You feel at once that attempts to dilate or split up would be useless.

The general position of the blood-vessels of the perineum also requires your attention in reference to the different methods of performing lithotomy. The internal pudic artery, after re-entering the pelvis between the greater and less sciatic ligaments, courses along the deep surface of the tuberosity and ramus of the ischium and ramus of the pubis, and passes obliquely forwards and inwards in the perineum, to which region it gives off several branches, some of which it is of importance to avoid in lithotomy. At first the pudic artery is bound down to the surface of the obturator internus muscle by the obturator fascia, and when the fat is cleared from the ischio-rectal fossa, the vessel, if well injected, can be felt through the fascial covering, lying about three-fourths of an inch above the internal margin of the tuberosity, and protected by the bone. At this part of its course it could scarcely be wounded in lithotomy unless the edge of the knife were not only lateralised but turned towards the internal surface of the tuberosity. As the pudic passes forwards in the perineum, it gradually leaves the protection of the ramus of the ischium, so that anteriorly, after it gives off the artery of the bulb, it actually lies between the layers of the triangular ligament, and is here in danger of being wounded if the knife be withdrawn transversely, or too much outwards, after division of the prostate.

The pudic artery, as it passes forwards, gives off branches to the perineum. Where it lies in relation to the tuber ischii it sends off the inferior hæmorrhoidal artery, which divides into two or three small vessels which traverse the ischio-rectal fossa,

and ramify on the lower part of the levator ani, and ultimately supply the lower part of the rectum. Some of these branches are necessarily divided, both in the lateral and bilateral operations of lithotomy, but seldom bleed much, and can be easily secured if they do. A little more anteriorly the pudic gives off the superficial perineal, a large artery, which supplies the more superficial textures of the region, and ultimately passes to the scrotum. This vessel pierces the obturator fascia, turns round the transverse perinei muscle, giving off small twigs which run parallel to the edge of that muscle, then continues its course obliquely upwards and forwards, lying along the internal surface of the erector penis muscle, and covered by the superficial perineal fascia. This artery must often be cut in the lateral operation, especially if the incision is not begun close to the raphé; but, as it lies superficially, it can be readily secured. M. Roux, however, observed, that if the surgeon lateralised his knife too much, and divided the artery near its origin, it might retract within the obturator fascia and simulate wound of the pudic; and when we consider that the vessel is stretched, by the scrotum being drawn up during lithotomy, I think that M. Roux's suggestion shows the necessity of beginning the incision close to the raphé, and not carrying it too far out towards the ramus of the ischium.

The branch of the pudic of most importance in reference to lithotomy is the artery of the bulb. This vessel arises from the pudic trunk, about fourteen lines in front of the anus, and crosses the perineum between the layers of the triangular ligament, sends off a small twig to Cowper's gland, and then enters the spongy portion of the urethra, immediately above the pendulous portion of the bulb. It is in general a short vessel, about the size of one of the digital arteries. On entering the spongy portion of the bulb it immediately subdivides into numerous minute twigs, which assume the peculiar arrangement of the erectile texture. It is not so much the size as the depth of this vessel, and its short origin from the pudic, that render it so dangerous a source of bleeding if wounded in lithotomy. In the ordi-

nary lateral operation, if we begin our incision not further forward than an inch and a quarter, or an inch and a half in front of the anus, and close to the raphé, and take care to divide the base of the triangular ligament low down, and then to push the finger upwards, as I pointed out when describing the perineal dissection, so as to feel the staff immediately in front of the prostate, there is no risk of this vessel being wounded if it occupies its normal position. The terminal branches of the pudic have no relation to the incisions in lithotomy, if their distribution be normal ; and at present, in considering the avoidable risks, I do not enter on the abnormal sources of hæmorrhage ; but, in regard to these, I would refer you to a paper I published on the sources of hæmorrhage in lithotomy in the *Edinburgh Medical Journal*, March 1842, vol. i.

Venous bleeding from the large prostatic veins in old men is a risk incident to all forms of perineal lithotomy ; but it is not of frequent occurrence.

As regards wound of the rectum, I would merely observe, that it is not in our first incisions that the gut is in danger. For a short distance above the anus the rectum becomes somewhat contracted, and curves back from the bulb and urethra. The part of the operation at which there is most risk of wounding the bowel is either in opening the membranous portion of the urethra, and carrying the knife onwards through the prostate, or in enlarging the wound in withdrawing the knife from the prostatic incision. At this deep part of the wound the rectum is distended into a large pouch ; and I confess that it is a wonder to me how the bowel escapes injury ; yet the accident is a very rare one—indeed I cannot recollect ever having seen it happen ; and what has also struck me as remarkable is, that though urine must constantly pass over the portion of the rectum where it is exposed in the upper part of the track of the incision, I never knew of a case in which ulceration in the gut occurred after lithotomy. The close proximity of the rectum to the prostatic incision, is well seen in the view of the track of the wound resulting from the lateral operation, Fig. 1, Plate lvi.

LECTURE CXIX.

Perineal Lithotomy, *continued*—Preliminary arrangements—Celsian Operation “on the Gripe”—Operation by the “Apparatus Major”—Lateral Operation as introduced by Frère Jacques—Description of the Modern Lateral Operation—Modifications of the Operation—Lateral Lithotomy in Children—Lithotomy in Patients who have been previously operated on—Bilateral Lithotomy : Advantages in certain cases.

HAVING directed your attention to the anatomy of the perineum in so far as it is connected with lithotomy, I now proceed to consider the different methods of performing that operation.

In lithotomy, besides the preliminary treatment common to all great operations, there are some special preliminaries to be attended to. On the day before the operation the patient should have a dose of castor-oil to open the bowels, and, about two hours prior to the operation, an enema of warm water should be administered, to clear out any feculent matter from the rectum. I generally advise the patient to take a draught of water about half-an-hour before the operation, so as to have a moderate amount of urine in the bladder; but if the patient cannot retain his water, or if the urine is passed as he comes under the influence of chloroform, the safest plan is to introduce the catheter, draw off the remaining urine, and inject about six ounces of tepid water into the bladder. The patient should be placed on a firm table, about $2\frac{1}{2}$ or 3 feet high, and the stool for the operator to sit on should be about a foot lower. In children there is no necessity to tie up the patient, the limbs are held in position by assistants; but in adults the patient must be properly secured. At one time this was done by means of long bandages, or lithotomy garters, as they were termed, wound round the wrists, hands, and ankles. All that is requisite, however, can be accomplished by the short lithotomy loop or garter represented in Plate liii. Fig. 4, applied

as shown in Fig. 1 of the same plate. This garter is fastened as follows:—the wrist is passed through the loop, which is then tightened; the assistants bend up the leg, and draw down the arm till the wrist is opposite the centre of the foot. The free ends of the garter are then passed one over the dorsum and the other under the sole, and tied firmly on the inside of the foot. If this be properly done and firmly secured, it will be found quite sufficient. The knees are then separated, and the limbs and pelvis maintained in the proper position by two assistants, one on each side. Special attention should be had that the pelvis is placed even, and the breech projecting over the edge of the table. As a general rule, it is advisable that the staff should be introduced before the limbs are tied up.

The instruments required will vary somewhat according to the method to be adopted, or any modification of the operation. In general terms, however, the apparatus required is a grooved staff; a sharp-pointed lithotomy knife; a probe-pointed knife for enlarging the deep incision, should that be required; different forms of lithotomy forceps and scoops for the extraction of the stone; and a gum-elastic tube, to be kept in the bladder after the operation. Besides these instruments, there should always be at hand a Reade's injection syringe, or other injecting apparatus, with tubes, for injecting water into the bladder previously to operating, or for washing out the bladder should the stone break during extraction; and of course the ordinary apparatus of artery forceps, ligatures, etc.

When lithotomy was first performed, it was done without any reference to anatomy. All that the operators thought of in those days was to get out the stone by the easiest and most direct method.

In the earliest or Celsian method, the surgeon introduced his fingers into the rectum and tried to grasp the stone and press it into the perineum till it formed a projection there. He then cut down upon the swelling in the perineum till his knife grated on the stone, and removed it either by tilting it out from behind by his fingers in the rectum, or by means of hook or

lever. This simple method was called "the operation of the gripe," or operation by the APPARATUS MINOR, and continued to be performed by some surgeons even till a comparatively recent period. In many cases this method of operating was successful, but in others quite the opposite. It was a very uncertain operation; for, whilst in some cases the parts divided to reach the stone might be those proper to be cut, in others the prostate might be completely divided, or the bladder cut above the prostate, or a portion of the rectum might be projected before the coats of the bladder, and a fæcal fistula result from its division. In truth, it was a mere matter of chance what parts were projected before the stone. There must always have been great risk of infiltration of urine occurring after such an operation. (See woodcut at end of Lecture.)

An Italian surgeon, Joannes de Romanis, introduced a method of operating, which was considered of a scientific character, founded upon an axiom of Hippocrates, "that wounds of the bladder are always fatal." This method was adopted by the family of Collot, in Paris, and continued to be practised by them for many years.

To avoid cutting the bladder, these surgeons began their incision in the anterior part of the perineum, and opened into the spongy part of the urethra, at or in front of the bulb, and then dilated or rather tore open the textures of the perineum, the membranous and prostatic urethra and the neck of the bladder, till the aperture was large enough to enable them to extract the stone. This was termed the method by the "APPARATUS MAJOR." One of its principles was "a small incision and large dilatation." And, properly understood, this is one of the principles of lithotomy in the present day. But their plan of dilatation was really extensive and deep-seated laceration. These surgeons used two instruments, at first merely as conductors for the forceps, these they afterwards converted into powerful dilators, which, instead of dilating the parts, lacerated them extensively. The urethra and prostate were either separated from the bladder or so torn up as at last to enable the stone to be got out of the

bladder. Subsequently compound dilators were used, which give enormous power to the surgeon, and with these the parts were still more torn and lacerated than before. This method, though very fatal, was more successful than we should expect, for, considering the force used and the way in which the parts were torn and bruised, the wonder is that any survived.

The operation on which the present lateral operation is founded, was introduced into France by an itinerant monk, the famous Frère Jacques. His operation, as he first performed it, though it was rapid and successful in regard to extracting the stone, was uncertain in its results, owing to want of precision as to the parts cut in opening the bladder. He used a sound without any groove, and having passed that into the bladder he plunged a dagger-shaped knife into the perineum, close to the left tuber ischii, carrying it deeply, towards the sound in the neck of the bladder, and at the same time cutting forwards in the perineum and inwards towards the raphé, so as to make a cut much in the position of the ordinary lateral incision. The stone was then extracted with the forceps or hook. This operation, like that of the gripe, was very uncertain, but it proved so much more successful than that by the apparatus major that it attracted the attention of surgeons, who taught Frère Jacques the anatomy of the parts. He then substituted a grooved staff for the plain sound, and made his incisions more methodically. His later operations were eminently successful; the number of cases on which he is said to have operated in different parts of the Continent seems almost fabulous.

It is very curious that the instruments which I show you, which are those still used by the native operators in the north-west provinces of India, are almost identical with those employed by Jacques in his first operations, namely, the ungrooved staff, dagger-like knife, and forceps with one handle, in the form of a lever-hook.

I shall now describe and demonstrate the method of performing the LATERAL OPERATION OF LITHOTOMY with the curved staff and knife.

The staff should be grooved obliquely, on the left side, between its convexity and concavity. The knife I prefer is that known as Liston's knife, moderately broad in the cutting part of the blade, sharp but not too long in the point, and bevelled off at the back, near the point, so as to glide readily in contact with the groove of the staff. The cutting edge extends only for about an inch and a quarter from the point, the part nearer the handle being blunted. (See Plate liii. Fig. 3.) The forceps require to be of different shapes, curved and straight, some with flattened, others with more hollowed blades, so as to grasp firmly different forms of stone, and some so arranged that the blades can be introduced separately to enclose the stone, and then locked by a sliding joint. The scoop should have one end hollow and the other curved, so as to act as a lever hook. The gum elastic tube must vary in length according to the depth of the perineum. In ordinary cases four or five inches will be sufficient. Before the operation a circle of cotton bandage is fastened round the abdomen, to which the tapes of the tube are secured after the operation is completed.

I shall now suppose that all the preliminaries have been attended to, and that the staff has been introduced and the patient placed in the proper position. The operator, seated before the patient, passes his finger into the rectum, feels the position of the staff, the relations of the prostate and membranous part of the urethra, and, having finally adjusted the staff, gives it to the assistant to hold. It should be kept steady, without any inclination of the handle towards the abdomen, and, in general, in contact with the stone in the bladder. The position of the staff is all important, more especially in children, or in cases of enlarged prostate in old men, for, if the handle be inclined towards the belly, the point of the staff may be withdrawn from the bladder, and lead to awkward or even serious results.

Having adjusted the position of the staff, and committed it to the assistant, who holds it with one hand, and draws up the scrotum with the other, the surgeon feels the space between the

Fig. 1

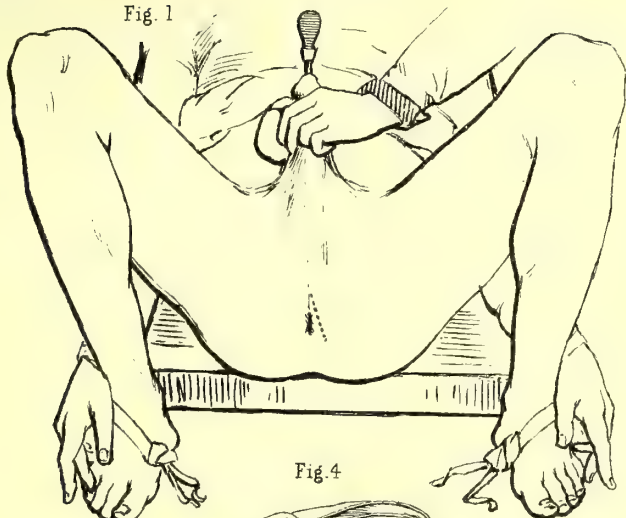


Fig. 4

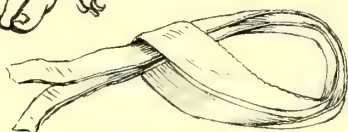


Fig. 3

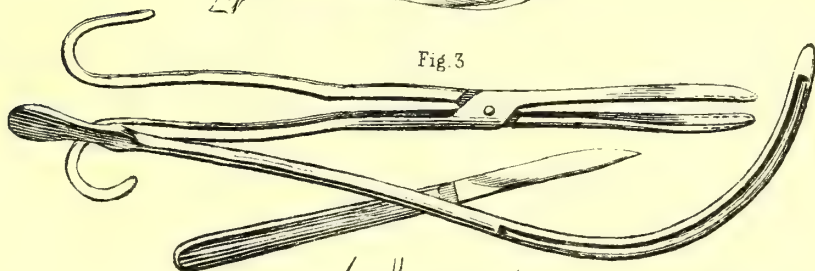
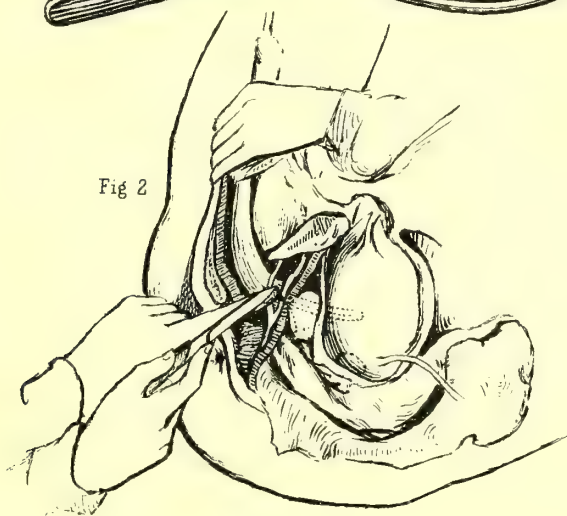


Fig 2





raphé and the tuber ischii, inserts his knife close to the left side of the raphé, about an inch and a quarter in front of the anus, and cuts obliquely downwards and outwards, so that his incision terminates at or a little beyond the lower margin of the anus, and about midway between the anus and tuber ischii, or rather nearer the tuberosity. I believe a great deal depends on the way in which this incision is made. The knife should be inserted deeply at first, and the incision deepened as it passes backwards. We shall thus have a clean decided cut, which should divide the skin, fat, superficial fascia, and the transversus perinei muscle. The surgeon then runs the edge of his knife lightly over the resisting muscular and fascial textures, and, inserting the forefinger of his left hand deeply about the middle of the incision, pushes it upwards in the direction of the sub-pubic arch. The soft textures are readily displaced by the finger, and he feels the groove of the staff thinly covered, just in front of the prostate. He turns the pulp of his left forefinger towards the staff, and inserts his nail in the lower margin of its groove, and, guiding the knife over his left forefinger, lodges its point in the groove, and feels it fairly in contact with the metal of the staff. He then lateralises the blade, and, keeping the back of the point of his knife in close contact with the staff, carries it steadily along the groove, through the prostate, till the point of the knife is arrested by the termination of the groove. (Plate liii. Fig. 2.) He now feels all resistance cease. The surgeon then withdraws the knife steadily from the prostatic incision, without cutting laterally ; but, as he withdraws it from the more superficial part of the wound, he presses aside the rectum, and cuts downwards and outwards, and divides any resisting texture which may have escaped division in cutting towards the staff. The operator then glides his left forefinger along the staff, through the prostatic incision into the bladder, and by a gentle lateral and downward movement he dilates or splits up the prostate, and touches the stone. If satisfied that the incision is sufficient to permit extraction, he desires the assistant to withdraw the staff, and then introduces the lithotomy forceps along his finger into the

bladder. On introducing the forceps the urine generally comes away with a gush, and, if the blades of the forceps be opened when just within the bladder, the stone is frequently carried between the blades and caught at once ; but the forceps should never be opened suddenly, nor until fairly lodged in the bladder, lest they should tear the prostate or neck of the bladder. If the stone is not caught as above described, the points of the forceps should then be directed downwards and backwards till they touch the stone ; their blades are then opened so as to seize it. (Plate liv. Fig. 1.) When the calculus is fairly grasped, the direction of the forceps is altered, the handles are depressed, and the extraction effected by drawing from above downwards, in the axis of the outlet, and towards its widest part. (Plate liv. Fig. 2.) If a number of small calculi or fragments of stone require to be extracted, the scoop should be used, as shown in Fig. 3. When the stone has been extracted, the surgeon should carefully examine the bladder, both with his finger and the bulbous searcher, to make sure that no other stones or fragments of stone remain. He then examines the wound to see if any vessels require to be secured ; and finally inserts the gum elastic tube, and secures it to the bandage round the waist.

When the lateral operation is performed, as above described, we have a funnel-shaped incision passing from below upwards, gradually diminishing in extent towards the neck of the bladder, and forming a free dependent outlet for the urine to flow by after the operation. The deep or prostatic incision, though limited in comparison with the superficial wound, is yet in such a direction as to give the longest diameter of the left lateral half of the prostate gland, without dividing the ileo-vesical layer of fascia, and amply sufficient to permit the safe extraction of a tolerably large stone. The lower part of the triangular ligament, and the other fascial and muscular structures closing the outlet, in the line of the incision, are fairly cut, and oppose no obstacles to the introduction of the forceps or the extraction of the stone. If the incision is placed low and made in the manner directed, neither the artery of the bulb nor the pudic trunk can be

Fig. 1

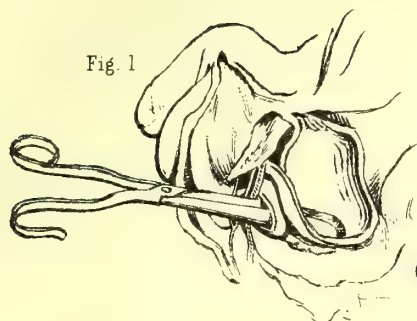


Fig 2

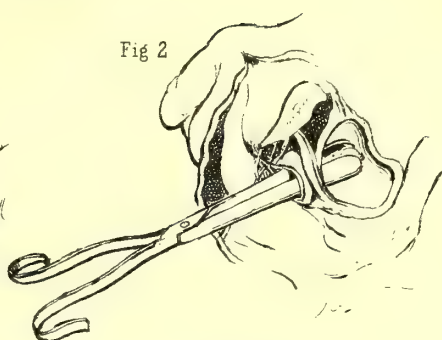


Fig 3

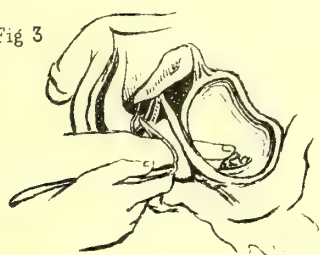


Fig 4

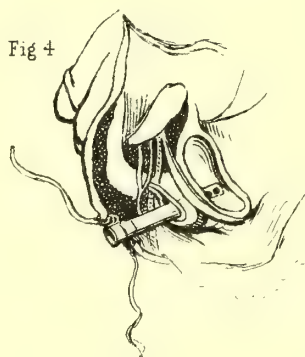


Fig.5

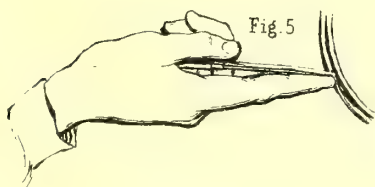


Fig 6



Fig.7

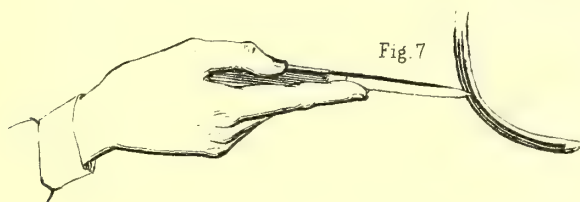


Fig.8

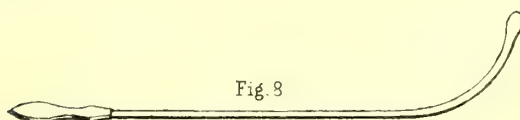
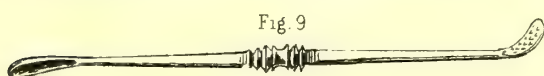
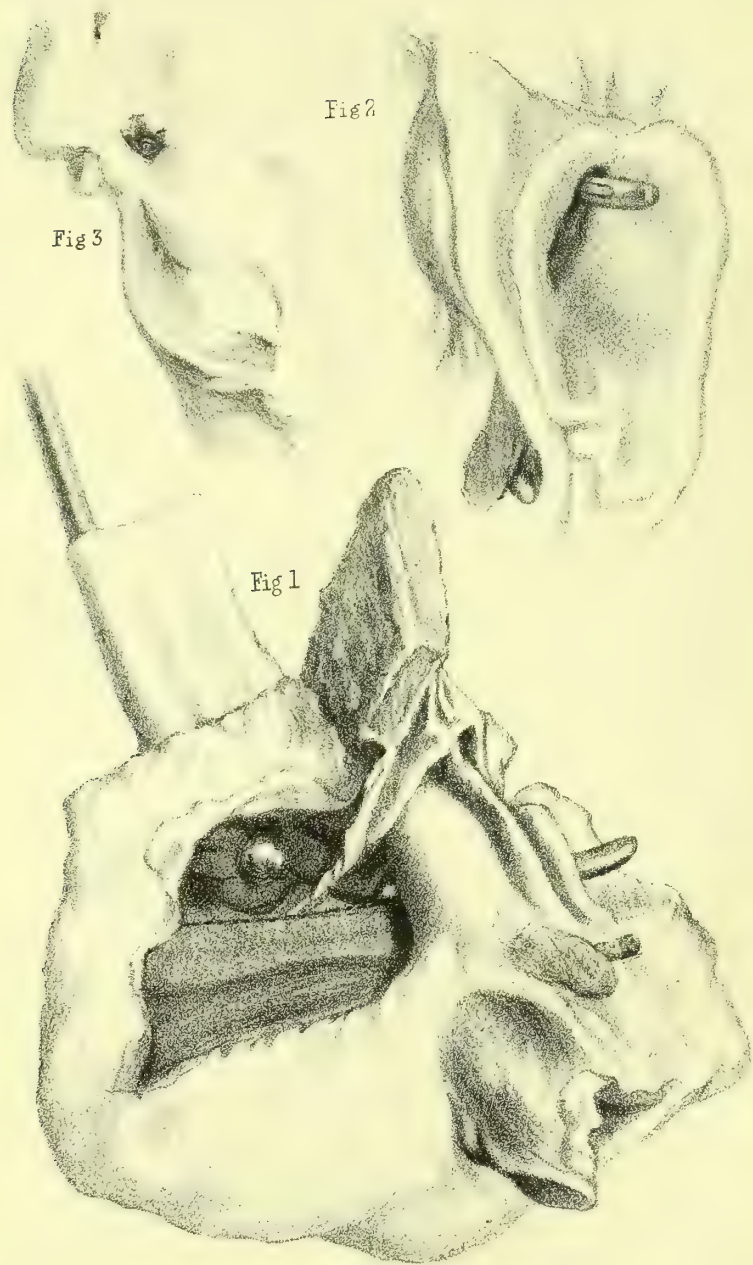


Fig.9



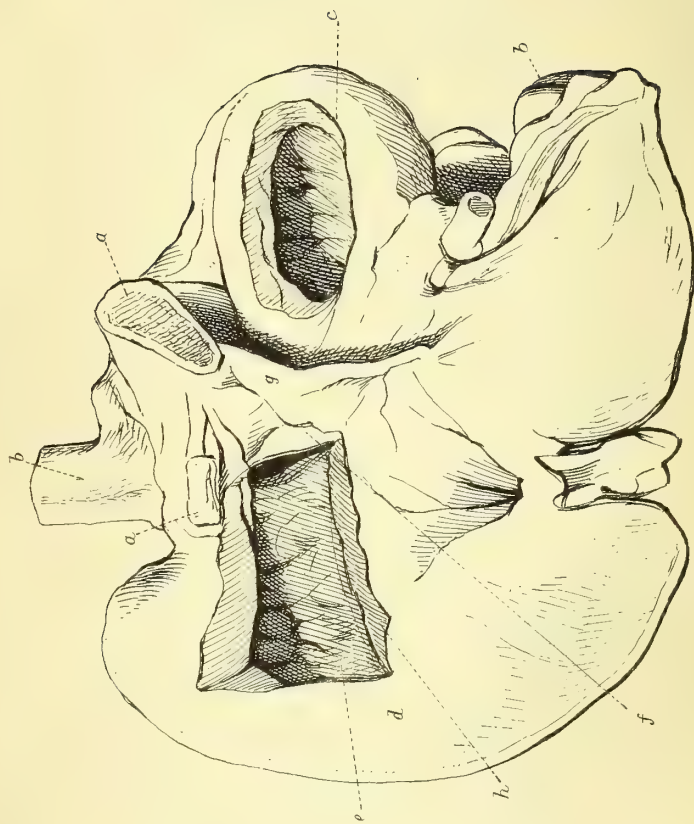


wounded if in their normal position, and even the superficial perineal can scarcely be cut, its small transverse twig and the anterior hæmorrhoidal branches being the only vessels divided ; so that the risks of infiltration of urine, and of hæmorrhage, are almost at the minimum ; whilst, by care in using the knife, and by pressing the rectum aside with the left forefinger in making the deep incision and in withdrawing the knife, wound of that intestine is not likely to occur, and in point of fact is a very rare accident. I therefore consider that the lateral operation of lithotomy is in general preferable to any of the other methods.

I have described the steps of the operation as usually performed, but various modifications are used by different surgeons, and numerous instruments have been devised to overcome difficulties, or with the intention of giving precision to the incisions. The different mechanical devices seem to me to resolve themselves into two general forms—1st, Those intended to facilitate finding the groove in the membranous part of the urethra, and carrying the knife easily along the groove without risk of its slipping downwards in taking the curve. Amongst these devices we have Earle's double staff, to enable the operator to cut directly from the skin into the urethra, a thing which no one now thinks of. And more recently we have Aston Key's straight staff and Buchanan's rectangular staff, both of which enable the operator to run his knife very easily into the bladder, and by attending to the angle formed by the knife, to regulate the extent of the prostatic incision. The second series of mechanical contrivances are the most numerous, and are those intended to ensure making the incision of the prostate of a determinate size. Such are the different forms of gorgets and broad knives cutting only to a limited extent, to be used for the prostatic incision, such as those of Desault, Cooper, Brodie, and Syme, and the lithotome caché. But, except in some cases of enlarged and rigid prostate, where a bluntish-edged gorget or the probe-pointed knife may be useful to enlarge the prostatic incision, the ordinary lithotomy-knife is far safer. I have never used any of these instruments

on the living, but I have tested most of them on the dead subject, and I feel satisfied that none of them gives such a perfect prostatic incision as the knife if properly used. In regard to the rectangular staff of Dr. Buchanan, I believe it to possess some decided advantages if used with the ordinary lateral incision. Every one must admit that it is much easier to carry the knife along a straight director, such as that formed by the horizontal limb of the rectangular staff, than to make it follow the curve of the ordinary staff; and if care be taken not to bulge forward the angle of the staff, so as to make it superficial, but to keep it held like the ordinary staff, the groove will be readily felt, and the knife run along it with great ease and certainty into the bladder, and without risk to the artery of the bulb, as I have repeatedly tested on the subject. Were I to make any change on the instruments I have been accustomed to use in operating on the living, I should be inclined to adopt the rectangular instead of the curved staff, but not to alter the line of the lateral incision.

In referring to the mode of feeling for and inserting the knife into the groove of the staff, I have described the method usually followed; but I very generally use the forefinger of my right hand, with the knife laid flat upon it, the back of the blade toward the left side, and the point not advanced to the pulp of the finger. (Fig. 5, plate liv.) With the knife so placed and protected, I pass the forefinger into the wound till I feel the groove of the staff in the membranous portion of the urethra, and then, when the pulp of the finger rests in contact with the groove, I project the point of the knife into it by a slight movement of the thumb, and at the same moment turn the finger laterally, as in Fig. 6, then withdraw my finger along the blade and handle, keeping the forefinger below the blunt part of the lower edge of the blade, so as to prevent the possibility of the point slipping out of the groove in taking the turn at the curve of the staff. The movements described are executed instantaneously, and almost imperceptibly, and ensure the knife being easily inserted into and carried along the groove, especially in a



deep perineum. In ordinary cases the method formerly described answers well enough.

In performing the lateral operation on young children, it is important to keep in mind that the bladder lies high up, and that, from the small size of the staff, great care is requisite to open into the groove, and still greater care in carrying the knife onwards into the bladder. The sensation of the knife grating along the groove should never be lost for an instant till the bladder is opened. Another rule specially to be attended to is, that when the staff is introduced into the bladder, and the stone touched by it, it should be held in contact with the stone from first to last, and the surgeon should never desire the staff to be withdrawn till he feels the stone distinctly with his finger. If these directions were attended to, the accidents of which we sometimes hear, of lithotomy being performed and abandoned after efforts at extraction, and of the bladder after death being found unopened by the incisions, could not occur. The real causes of such misfortunes seem to me to be, either that the point of the staff has slipped from the bladder, and so misguided the knife, or that the knife has slipped from the groove in taking the curve, and thus when the operator passes up his finger, the loose cellular tissue between the bladder and rectum is broken up with the finger, and he mistakes it for the cavity of the bladder, and feeling the stone perhaps through the thin coats of the bladder above, he makes futile attempts at extraction. I repeat, the forceps should never be used till the surgeon feels the stone distinctly with his finger. In extracting the stone, either in the adult or child, it occasionally, though rarely, happens that it slips from the forceps after having passed the opening in the prostate. In such circumstances the operator should insert his finger into the rectum, so as to fix the stone from behind, and prevent its slipping back, and then with the curved lever end of the scoop draw or tilt it out of the wound.

It occasionally happens that a patient who has been the subject of lithotomy is again affected with calculus, and requires to be again operated on. In such circumstances it has been

advised that the incision should be made on the right side of the perineum, and the right lateral lobe of the prostate divided. The reason assigned for this recommendation is, that the textures formerly cut will be so condensed and resistant as to render their division and the extraction of the stone very difficult. I have had occasion to operate on a patient, fifteen years after he had been operated on for stone by another surgeon. The patient was a big, stout man, above sixty years of age, with all the appearance of a very deep perineum. I performed the ordinary lateral operation, dividing the old cicatrix, and not only met with no difficulty, but feel satisfied that the textures were atrophied so as to render the perineum shallower, whilst the prostate, usually rigid in old men, offered no resistance, the incision yielding easily to the pressure of the finger. In a word the operation was easier than usual in performance, and there scarcely was a tablespoonful of blood lost. So that, in such cases, I see no reason for performing lithotomy on the right side of the perineum.

The *BILATERAL OPERATION* of lithotomy, as its title implies, has for its object the section of both lateral lobes of the prostate, so as to give a larger opening at the neck of the bladder, without division of the fascial structures which oppose the risk of urinary infiltration. In performing the lateral operation, it has long been a rule with surgeons, when the stone was found of a size larger than was likely to be easily extracted by the section of the left side of the gland, to divide the right lateral lobe with a probe-pointed bistoury. Baron Dupuytren, however, proposed the special operation as the safest, and therefore the preferable method in all cases, as he considered it diminished both the risk of infiltration and hæmorrhage; and, by giving the largest possible opening in the prostate, avoided the risks arising from bruising the deep textures in extracting the stone, and the line of the external incision was allowed to correspond to the double incision of the prostate. The bilateral operation of Dupuytren is, as described by himself, the Celsian lithotomy,

performed on anatomical and scientific principles. The external incision is placed rather less than an inch in front of the anus, and is of a curved form, the concavity of the curve looking back towards the anus, the horns of the incisions directed towards the hips, and about $2\frac{1}{2}$ or $2\frac{3}{4}$ inches in extent. A staff grooved on the centre of its convexity, and somewhat more curved than the ordinary staff, is introduced prior to the operation being commenced, and held in the usual manner by an assistant. The incision I have described divides the skin, fat, and fasciæ, down to the muscles and central point of the perineum. The connections of the sphincter ani and other muscles at the central point are divided, the lower part of the rectum pushed backwards, and the bulb of the urethra pressed forwards. The forefinger of the left hand is then passed deeply at the centre of the wound, to feel the groove of the staff in the membranous part of the urethra, and from the very convex form and open groove of the staff, it is usually easily felt. The membranous urethra is then opened freely, so as to expose the groove, and the operator inserts the beak of the double lithotome caché—a special instrument for double section of the prostate. The closed lithotome is glided along the staff with its concavity towards the groove, until it is felt to enter the bladder and touch the stone; then the concavity of the lithotome is turned back towards the posterior surface of the bladder and prostate. The staff is, in general, withdrawn, so soon as the surgeon satisfies himself that the lithotome has touched the calculus in the bladder. The extent of the prostatic incision is determined by adjusting the projection of the blades of the lithotome previously to the operation, by means of a screw moving on a graduated scale. The concavity of the lithotome having been turned towards the inferior aspect of the bladder, and having its beak projecting within the cavity, the operator then opens the blades by pressing on the lever spring at the handle, and withdraws the instrument steadily downwards through the external incision. The prostatic incision is then gently dilated by the finger, the

forceps introduced, and the stone extracted, as in the lateral method. I have never performed this operation on the living. In some cases where the stone was large I have divided the right side of the prostate with the probe-pointed bistoury, and in ordinary cases I have found this to answer well enough ; but in a case on which I had to operate lately, where the stone was of a very large size and of a disc-like or circular form, lying across the cavity of the bladder, which it nearly filled, I found great difficulty in seizing and extracting the stone, even after free division of the right side of the prostate and enlargement of the lateral incision, owing to the obliquity of the stone in reference to the lateral incision ; and I feel satisfied that the bilateral operation, with the external incision somewhat modified, would render the grasping and removal of the stone much easier. Moreover, I think every surgeon who has had to enlarge the prostatic incision, by cutting the right side of the gland with the probe-pointed knife, must have felt a want of certainty as to the exact extent and direction of this second incision ; whereas the double lithotome, as now improved, makes a perfectly smooth incision, passing equally through each side of the gland obliquely downwards and outwards in its longest diameter. My objection to the external incision of Dupuytren's method is, that it really does not correspond to the prostatic incision, is very limited in extent, and does not afford a free exit for the urine. The semilunar incision no doubt is intended to present two dependent points at the horns of the crescent ; but if we look at the external incision when completed on the subject, or in the representation given of it in the posthumous work of Baron Dupuytren, edited by M. Sanson, we see that the wound is no longer crescentic, that the skin towards the anus stretches across in a straight line forming the chord of the arc, so as to prevent the urine escaping readily. Were I to perform the bilateral operation, I should begin the external incision about an inch in front of the anus, and then carry it obliquely downwards and outwards, as in the lateral operation, first on the left

and then on the right side of the perineum, so as to form two oblique lateral incisions converging at the raphé. Such a form of incision would give greater space for extraction of a large stone; and, by corresponding to the direction of the bilateral section of the prostate, would permit of a free exit for the urine. In other respects, I should follow the steps of Dupuytren's operation, as already described.



LITHOTOMY "ON THE GRIFE."



LECTURE CXX.

Lithotomy, *continued*—Mesial Operation—Recto-vesical Operation—Points to be attended to in regard to Extraction of the Stone—General After-treatment—Hæmorrhage—Infiltration of Urine after Lithotomy—Suppression of Urine—Inflammation of the Neck of the Bladder—Pyæmia—The Author's experience of the results of Lithotomy Cases — Remarks on Statistics of Lithotomy—Lithotomy in the Female.

IT now only remains for me to describe the two forms of the mesial operation, which I must do very briefly. The simple *Mesial Operation of Lithotomy* is performed as follows :—A staff somewhat similar to that used in the bilateral operation is introduced into the bladder, and given in charge to an assistant, and the patient is then secured in the usual manner. The surgeon commences his incision about an inch and a half in front of the anus, exactly over the central line or raphé, and continues it back till within a few lines of the anus. This incision is carefully deepened anteriorly until it exposes the posterior part of the accelerator urinæ muscle covering the bulb, and the posterior fibres of that muscle are divided in the middle line, and the bulb pressed forwards and guarded by the finger, the rectum pressed backwards, and the finger feels for the staff in the membranous part of the urethra. The point of a narrow knife is now entered into the groove of the staff, with the back of the blade directed towards the rectum. When the knife is felt to have entered the bladder, the cutting edge is turned back towards the lower surface of the prostate, and carried down through the substance of that gland exactly in the middle line, the rectum being at this stage protected, and pressed back with the forefinger of the left hand. The wound is next dilated with the finger, and when the stone is felt the staff is withdrawn, and the forceps or scoop introduced and the stone extracted. In some

respects this operation might seem the simplest, and as most completely avoiding the risks of infiltration and hæmorrhage. The incision of the prostate cannot implicate the reflexion of the pelvic fascia. There are no vessels in the central line of the perineum to cause bleeding, the only risk being wound of the bulb if not properly guarded, and besides, the opening towards the neck of the bladder is direct and shallow. But then the space for extraction is very small. The fascial and muscular textures closing the outlet being, as it were, merely separated in the mesial line, not divided, oppose resistance to the free use of the forceps, and the easy extraction of stone, so that even on the dead body the extraction of a stone of very moderate dimensions is attended with the sensation of drawing a tight cork from a bottle. Mr. Allarton, who some years ago tried to revive this method of operating, considered that, by merely notching the apex of the prostate, the prostatic portion of the urethra and neck of the bladder could be dilated without further cutting; but from repeated trials on the dead bodies of adults I found that no stone could be extracted in that way, except of such a size that it could have been easily removed by lithotrity. I consider the mesial operation, though apparently simple, to be really more dangerous, and less suited for extraction of a moderately-sized stone, than the lateral method.

The other form of mesial operation—the Recto-Vesical—is one which has been practised principally in Italy and by some surgeons in this country, apparently with success as regards safety to life; but it is so obviously liable to the risk of being followed by recto-vesical fistula, that it is not likely to be adopted, except in special cases, to enable us to extract a large calculus through the widest part of the outlet of the pelvis, or where, as happened in one of Mr. Liston's cases, a portion of a large stone is sacculated and fixed between the bladder and the rectum.

The steps of the operation are very simple. The staff having been introduced, and the other preliminaries attended to, the surgeon begins his incision as in the mesial operation, only carrying it back to the verge of the anus. He next dissects

towards and opens the membranous part of the urethra, and runs his knife along the groove of the staff into the bladder. He now introduces the forefinger of his left hand into the rectum above the base of the prostate, to guide the knife. Next, by raising the handle of his knife, he depresses its point, so as to puncture the bladder immediately above the base of the prostate, and then placing his left forefinger so as to press on the projected point of the knife, he carries it down, dividing the anterior wall of the rectum, prostate, sphincter ani, and intervening structures in the central line. Or he may proceed in a different and more summary manner. Placing two fingers of the left hand into the rectum, as for puncture of the bladder, the surgeon feels the groove of the staff above the base of the prostate, and then introducing a long sharp-pointed curved bistoury flat upon the fingers, he turns its point forwards, punctures the bladder in the groove of the staff where it is felt above the prostate, and by throwing back the handle of the bistoury carries its point forwards along the groove into the perineum, projects it through the skin about an inch in front of the anus, and then drawing the blade towards himself, lays the track of the wound through the bladder, urethra, and rectum, freely open. Through this large wound any stone that can possibly pass through the inferior outlet of the pelvis may be extracted; and whilst few will be found who would follow this method as a general plan, I should undoubtedly prefer it to the high operation for the extraction of large calculi, and, as I have stated, the results in regard to safety to life, and even as to the healing of the recto-vesical wound, are more satisfactory than we might have expected. The risk of hæmorrhage must be kept in mind, for hæmorrhage from branches of the middle hæmorrhoidal artery, or from the inferior part of the prostatic plexus, is liable to occur, but from the size of the opening, the bleeding, if noticed, can in general be easily arrested by ligature or pressure.

Before concluding the consideration of the operative procedure in lithotomy, I would draw your attention to the im-

portant point of extraction of the stone. In most cases, if the stone is of a moderate size, and if a clean incision has been made, sufficient to admit of the easy introduction of forceps of sufficient size and grasp, and if these are introduced and used as directed and as indicated in the diagrams in Plate liv., you will generally meet with no difficulty in seizing and extracting the stone. But when the stone is large, or the perineum very deep, as in the case of enlarged prostate, the difficulties are increased, and in some rare cases the stone may be so placed as to require the use of curved forceps. In my own practice I have in three instances only met with difficulty in extracting the stone. In one of these the patient had an enormously enlarged and rigid prostate and very deep fat perineum, and the difficulty was not, properly speaking, in the extraction of the stone—a small flat one—but in feeling it with the forceps to seize it. It was easily felt with the sound and staff, but it lay flat in the *bas-fond* of the bladder behind the prostate, and even the curved forceps reached it with difficulty, and the bladder was far beyond the reach of the finger. The patient recovered from the operation, but died about four months afterwards from a paralytic attack, so that I had an opportunity of obtaining the parts, which are in my museum. The track of the wound is still visible, though contracted to a mere line, and the measurement from the external incision to the opening in the bladder is fully six and a half inches, even in the dissected preparation. With the exception of that case, which occurred many years ago, I have met with no difficulty in extraction, though I have removed some large calculi, until during the past year, in which I met with two cases. In both of these the perineum was deep, but not of the excessive depth of the case I have mentioned. In one of them the difficulty in seizing the stone was principally due to my neglect of a precaution which I generally take, of making sure of the bladder containing a moderate amount of fluid. The incisions were rapidly effected, but when I introduced my finger and felt the stone, I found that there was very little urine, and that the bladder was contracted so as to render the use of the forceps

difficult. The stone, a large flat one, was resting in close contact with the left side of the bladder, and I felt that moving about the forceps would do no good. I therefore introduced the curved lever, and displaced and seized it with a pair of curved forceps, and extracted it without using any force, and without, perhaps, any very great delay; but I believe, that had I injected the bladder before the operation, the stone would have been seized and extracted with ease. The third case was one of real difficulty, owing to the large size and form of the stone, and the position it occupied in the bladder. The patient had suffered from symptoms of stone for above thirty years, and had a contracted perineum and ankylosed hip-joint, owing to old-standing disease of the hip. I felt the stone to be a large one, but never could form a very decided idea of its size. It did not feel very thick, and indeed was only an inch and a half thick in the centre, and much thinner at the edges; but it was nearly circular, being 3 inches 5 lines in one diameter, and 3 inches 2 lines in the other. It lay obliquely across the bladder, which was small and nearly filled by the stone. I felt it was too large to pass through the single lateral incision of the prostate, and therefore divided the right lateral lobe of the gland also; but, from the position which it occupied, it was difficult to open the forceps so as to seize it, and when seized, the raised centre of the stone did not give a very secure grasp, and it slipped several times before I succeeded in extracting it. As I have observed, when speaking of the bilateral operation of Dupuytren, I believe that method would have enabled me to reach and seize the stone more readily than I could by the lateral superficial incision, even with bilateral section of the prostate, and I should have recourse to the bilateral operation in cases of very large calculi. Still, as a general rule, extraction of the stone is not difficult. If the stone be not caught at once, however, two errors of opposite kinds may be made,—the forceps may be passed too deeply into the bladder, overshooting the stone, or in trying to avoid this they may not be passed sufficiently below it, so that the blades merely catch the end of the stone and do not grasp it fairly. In ordinary cases, the

position of the stone can be felt with the finger, and then, when the forceps are introduced and touch the stone, by gently opening the blades and pressing one of them against the posterior wall of the bladder, so as slightly to shake the parts, the stone will often fall within their grasp. Or, after feeling the stone with the closed forceps, by turning the blades away from the stone, and then opening them, and making a half-turn over in the direction of the stone, you will generally seize it. In some cases there can be no great risk in opening the blades pretty widely, and drawing them gently over the inferior and posterior surface of the bladder, to catch the stone; but I have a great objection to sudden plunges, or opening and shutting the forceps rapidly in hope of seizing the stone, as that is apt to injure the coats of the bladder.

In regard to the after-treatment of lithotomy cases, there is not a great deal to be said. If hæmorrhage comes on after reaction, it must be arrested by tying the bleeding vessels if necessary; or, if deeply seated and venous, slips of lint are pushed up along the sides of the tube to control it. In most cases all that is required is to give the patient an anodyne draught to allay pain and irritation; and to see that the tube is kept clear, by occasionally passing a feather or small gum-elastic catheter through it, or by injecting a little tepid water with a small glass syringe, so as to avoid all forcible injection. The diet for the first few days should be rather low, and the patient should drink freely of thin barley-water or other diluents, to increase and dilute the secretion of urine; the more he wets, the better. After forty-eight hours in the adult, or twenty-four to thirty hours in children, the tube should be removed, as the track of the incision is by that time covered with plastic effusion, and the urine flows over it without risk. The wound gradually contracts and heals, although at first the action of the urine gives it a dirty sloughy appearance. From the eighth to the tenth day some urine begins to pass by the urethra. It not unfrequently happens that, immediately after the tube has been removed, the urine passes by the urethra in full stream. This, however, is only temporary, and is due to swelling of the prostate

closing the incision through its substance on withdrawal of the tube, and as the swelling subsides, the urine again passes by the wound. In some cases retention supervenes, and may lead to danger. In one case of a young man on whom I had operated, I removed the tube at the usual time. About twenty-four hours afterwards, when making my visit, I was summoned to see him, as hæmorrhage had occurred. As there had been no bleeding of consequence during the operation, I was rather surprised, but on going to him I found that there was smart florid bleeding. He stated that he had been trying to pass water, and on examination I found the bladder distended and the penis semi-erect. I passed a large gum catheter by the wound, expecting to find the bladder distended by blood, but it was full of clear urine, and so soon as the bladder was relieved all bleeding ceased and never recurred. The swelling in the deep part of the wound had caused retention, and the irritation and straining had caused engorgement of the organs and bleeding from congested vessels in the wound. It is not unusual, when the urine begins to pass again by its natural channel, to find the patient complain of a slight rigor or shivering; but this is merely due to sympathetic irritation, as the rigor that often follows the introduction of a bougie, and unless there be a repetition of the rigor or marked increase in the rapidity of the pulse, the symptom need not cause alarm.

If the incision has been carried too far laterally or upwards, infiltration of urine into the cellular tissue around the neck of the bladder may occur. The symptoms may supervene from twenty-four to forty-eight hours after the operation. The skin becomes hot and dry, the tongue furred, and the pulse quick. Gradually the patient becomes very restless, complains of a sense of fulness or pain in the hypogastrium, and there is some degree of tympanitic distension. The pulse becomes weak and irritable, and gradually begins to intermit; the intermissions becoming more frequent as the diseased action proceeds; the patient has a sunken, anxious expression, fumbles with the bedclothes, there is frequent hiccough, and incoherency or muttering

delirium, and he at last sinks and dies comatose. On examination after death in such cases, the track of the wound is found discoloured and disorganised, and the fine loose cellular tissue around the neck of the bladder, and in relation to the reflection of the peritoneum, is found sloughy and infiltrated with unhealthy purulent matter. This condition, however, must be very rare. I have never yet seen these appearances in the autopsy of any lithotomy case, and Sir William Fergusson, in his lectures before the Royal College of Surgeons of England, states that he has never seen it, and seems to think that the risk of infiltration has been much exaggerated. I should, however, be rather inclined to say that the attention which has been directed to this source of danger, and the care taken as to the direction and limitation of the prostatic incision in modern lithotomy, have in a great measure obviated it. Should this condition arise, I fear we can do very little to remedy it, beyond giving stimulants and trying to support the patient's strength. Sir Benjamin Brodie mentions a case in which, by laying the track of the wound and the cavity of the rectum into one, allowing the escape of the sloughing tissue, he saved the patient, but I am not aware that the treatment has ever been repeated by any other surgeon.

A limited form of infiltration or foul urinary abscess may occur from imperfect division of the anterior fibres of the levator ani or other tissues, if these prevent the free flow of urine by the wound. The use of the tube, however, tends to prevent such lodgment, by maintaining a free outlet for the urine until the loose textures are consolidated by plastic lymph. For this reason, and also because it may be useful in enabling us to plug the wound in the case of venous bleeding, I consider its use advisable, and if it seems to produce irritation it can be easily removed.

Suppression of urine occasionally, though rarely, follows lithotomy, as it does other operations on the urinary organs. I have met with only one instance of it in my own practice, in the case of an old stout man. There was no loss of blood during, nor any irritation after, the operation, but from the first four hours after the

operation he passed no urine, nor felt any uneasiness. The day after the operation his pulse was seventy-two, regular, and of fair strength. He had no anxious expression, and felt no pain or pressure over the bladder, and when I visited the ward he was lying reading a newspaper. Everything seemed so favourable, that beyond introducing a gum catheter through the tube to satisfy myself that there was no water in the bladder, and then injecting a little tepid water, I did not think it necessary to interfere beyond directing a sinapism and hot fomentations over the lumbar and hypogastric regions. Next day his pulse was irregular, still he was quite collected and said he felt no pain, but he gradually became comatose, and died about sixty hours after the operation. I obtained an examination of the body. There was no appearance of disease or irritation in the peritoneum or abdominal viscera, with the exception of an enormous amount of fat. The bladder was free from any trace of inflammation, the track of the wound healthy, and the direction and extent of the prostatic incision all right. Indeed, the sketch of the wound after lithotomy (Plate lv.) was taken from this case. Both kidneys were very much congested, as also the renal veins, but there was no appearance of any structural change or disease of the kidneys. Were I to meet with a similar case, I should lose no time, however slight the general symptoms, in using the vapour bath and other means to induce free diaphoresis, as well as employing powerful counter-irritation over the lumbar region.

Inflammation of the neck of the bladder, attended by excessive pain at the point of the penis, nausea, rigors, and other symptoms, occurring from six to eight days after the operation, is mentioned by some surgeons. I have never seen a case of this affection. The treatment recommended is depletion by leeches applied over the hypogastrium, or to the verge of the anus, opiate enemata or suppositories to allay pain, and diluent drinks and antiphlogistic regimen.

The symptoms described as ushering in this inflammation of the neck of the bladder, as well as their progress and usually unfavourable termination, have a strong resemblance to those of

phlebitic pyæmia. That unfortunate complication arises in old or elderly men from irritation and inflammation of the large prostatic veins, branches of the inferior plexus, being necessarily implicated by the incision. The symptoms generally manifest themselves by a rigor, fever, quick pulse, and slight nausea, about the eighth or tenth day. In one of my cases—a gentleman, fifty-eight years of age—the symptoms did not supervene until the fourth week, when the wound was all but healed. The patient had gone on most favourably, and I had ceased to visit him except occasionally. On calling one day he complained of not feeling so well, and attributed it to having partaken rather largely of hare-soup; but his pulse was quick, and he had some tenderness over the liver; as he had suffered from hepatitis in a warm climate, I was in hopes that the symptoms might pass off; but the next day he had two rigors, and had vomited several times. The small portion of the wound which remained open was dry. The pulse was 140, and the skin was hot, dry, and slightly jaundiced, and he died about a week from the accession of the bad symptoms. The wound had contracted, and there was no trace of irritation in the bladder; the prostatic veins were engorged, otherwise they seemed healthy, but the liver was studded with numerous abscesses.

My experience from the results of my own practice, as well as my observation of the practice of other surgeons, leads me to believe that, apart from the operative procedure, the mortality in lithotomy is mainly due to causes not under our control. The size of the stone in relation to the width of the parts through which we must extract it, and a rigid unyielding condition of the prostate met with in some elderly and old men, in whom we also most generally find enlarged prostatic veins, seem to me the conditions which continue to diminish the favourable statistics of lithotomy. Of children and boys under twenty years of age I have lost only one patient, and in adults between twenty-one and forty only one; but out of thirty patients between the ages of forty and eighty-two I have lost seven, and all these fatal cases occurred in patients between the ages of fifty-six and seventy-

two. All of them were large fat men, and in all of them the prostate was rigid, and the stone above the average size, with one exception, where it was of moderate size, and in none of the fatal cases was there any difficulty in the operation, except in the patient seventy-two years of age, where the stone was very large and the perineum unusually contracted from old disease of the hip-joint.

Of these patients, one died from continued venous bleeding or oozing, which neither plugging nor other means served to arrest. The patient was an old man with a deep perineum, but the operation was very easily performed, and there was no bleeding during its performance, nor for some hours afterwards. The lint prevented any bleeding from the wound, but clots oozed through the tube. I was anxious to obtain an examination, as the patient had suffered formerly from severe attacks of hæmaturia, but leave was refused. One case already mentioned died of suppression of urine, and four cases died from phlebotic pyæmia. Five of these patients were from sixty-five to seventy years of age, and one was fifty-six. One case, that of the old man seventy-two years of age from whom I extracted a very large stone, went on favourably for some days, and then died apparently from exhaustion. The two remaining fatal cases were young patients,—the one a child of four years of age, the other a young man of twenty-two. The circumstances of both these were peculiar. The child had suffered from symptoms of stone almost from his birth; but, except that he was very irritable, and that the urine was phosphatic, he seemed in fair condition. I extracted two calculi with great ease, and felt no anxiety as to the result. Next day I found him restless, and he had vomited, as was supposed, from the chloroform; but he had also diarrhoea, the stools being of a dark-green colour. The urine had passed freely by the tube and wound. As he was very restless, I withdrew the tube. Vomiting and purging of a green colour continued almost without intermission, and he died in thirty-six hours after the operation. That his evacuations were healthy prior to the operation I can testify, for owing to some neglect, an enema had not been administered, and the fæces were evacuated when he was

being brought under the influence of chloroform. I obtained the parts operated on, and they show that the direction and state of the wound are as perfect as could be desired. (Plate lvi.) This is the only fatal case I have had in children, and I feel at a loss to account for it, as there was no disease of the kidneys or liver, but merely congestion and irritation of the mucous coat of the stomach.

The young man, although twenty-two years of age, might have passed for fourteen or fifteen; he was extremely emaciated, stunted in growth, and sallow, had suffered intense pain from stone in the bladder from infancy, but both he and his friends had refused to permit any operation, until his sufferings became so excessive that he could endure them no longer. He had a quick irritable pulse, dull pain over the abdomen, particularly in the right iliac region, and tenderness on pressing the perineum. The case was evidently a most unfavourable one, but, as his only chance of relief lay in the operation, I performed it after some preliminary treatment. There was no difficulty in its performance, as I extracted a large phosphatic calculus with ease. The day after the operation, I found him in great spirits owing to the relief from his previous symptoms, and for about a week he went on so well that I began to hope for a favourable result. But he then began to complain of general uneasiness, thirst, and want of appetite, and gradually sank, and died fifteen days after the operation, apparently from sheer exhaustion, without any rigors or other marked symptoms. On examination, the kidneys were found diseased, the coats of the bladder thickened, the mucous coat presenting the appearances of chronic cystitis. The textures in the course of the wound were not altered, but on the right side there was a large chronic abscess occupying the iliac fossa and passing down into the true pelvis. All these morbid conditions were traceable, I think, to the long-continued irritation caused by the stone.

In regard to the statistics of lithotomy, it has long been understood that the average of successful results is greatly deter-

mined by the proportion of young patients operated on. If the number of children be large, the results will be proportionately successful. This circumstance, I think, accounts in some measure for the variations of success which, not only individual surgeons, but particular hospitals may experience. In the earlier years of my practice a great many young patients came under my treatment, and for a long time I never lost a patient, but latterly young patients seem to have become scarce, for I find the youngest I have operated on during the last four years was a gentleman thirty-five years of age.

If an hospital be situated in the vicinity of what I may term "a stone district," it will be most likely to receive a great many more children suffering from calculus than an hospital at a considerable distance, for parents are naturally unwilling to be parted from their children under such circumstances. Now that many surgeons in the country operate, comparatively few children with stone are brought to Edinburgh, except from the vicinity; whilst adults still resort to it, for the benefit of surgical aid, from Caithness and other districts where stone is of frequent occurrence.

As to the statistics of lithotomy in the future, I am also inclined to think that these will appear less favourable than formerly, because the cases now properly chosen for lithotrity—namely, those in which the stone is small, the bladder not very irritable, and the other urinary organs generally healthy—are just the cases which were the most favourable for lithotomy. Hence the abstraction of such cases will diminish the average of successful results, and make lithotomy appear more fatal than it used to be.

I have had no experience of lithotomy in the female, and, as I have already stated, I consider lithotrity as in all respects preferable to lithotomy or dilatation; but in any case of large or hard calculus, where lithotomy is required, the operation is performed as follows:—The patient being under chloroform, and held in the ordinary position, a straight grooved staff or director

is passed along the urethra into the bladder. The surgeon then passes a straight probe-pointed bistoury along the groove of the staff into the bladder, and cuts obliquely downwards and outwards, but merely to a very small extent, so as to divide the urethra ; by dilatation with the finger sufficient space is gained to admit of the extraction of a large stone. Some advise that the incision should be carried upwards and outwards, but I think that is attended with greater risk to the termination of the pudic artery, and besides, it places the incision in the narrowest part of the outlet of the pelvis.

LECTURE CXXI.

Diseases of the Urinary Organs—Retention of Urine from a Calculus in the Urethra : from Injuries ; from Paralysis or Atony of the Bladder—Disease of the Prostate Gland—Catheterism in cases of Enlarged Prostate—Methods of relieving Retention when the Catheter cannot be passed.

IN to-day's lecture I begin the consideration of those diseases of the urinary organs which present the common symptom of retention of urine.

RETENTION OF URINE may arise from various causes, mechanical and constitutional. A direct mechanical obstruction is sometimes met with in the shape of a calculus impacted in the urethra, which effectually prevents the flow of urine. This often occurs in children as well as adults, and the accompanying symptoms are severe in direct proportion to the size of the stone. In children the calculus is generally small, and—owing to the great contractile power of the bladder, and direction of the urethra—it is generally projected far forward by the force of the urine—whence it is only prevented from being completely ejected by the narrow orifice of that canal.

In treating such a case it is necessary, in order to remove the foreign body, to press it forwards towards the orifice of the urethra, and then if possible to expel it. If the orifice be too small to allow of this, it should be slit open, and the calculus then removed, after which the urine will flow freely. In the event of the textures being divided, it is necessary during the after-treatment to pass a catheter occasionally, so as to prevent the parts from contracting too much during the healing process.

In the case of an adult, owing to the direction and curvature of the urethra, a calculus generally becomes impacted at a more posterior portion of the urethral canal. I have often had occa-

sion to cut down upon the spongy portion of the urethra in order to reach the stone lodged in the sinus of the bulb. In one case of retention of urine I passed a gum-elastic catheter without much difficulty, and without feeling or expecting to find a stone, and drew off the urine ; but I discovered that I could not withdraw the catheter. On examining the perineum I at once felt the cause ; the catheter had, in its turn, become impacted between the upper wall of the urethra and two large calculi, contained in the dilated sinus of the bulb ; and as these could be easily felt, I cut down upon and removed them, and left the catheter in the bladder for thirty-six hours.

Sir Astley Cooper and others have recommended us to extract calculi from the urethra by means of an instrument formed for the purpose with expanding prehensile blades. But it is difficult to open these blades when in the urethra, so as to grasp the stone, and even if we succeed in this, it is difficult to effect extraction ; so that this mode cannot always be trusted to. The best plan is to press the calculus forwards to as near the meatus as possible, and then eject it, or, if too large, increase the orifice by incision. If it be placed farther back, then fix it in front of the bulb, and cut down upon and extract it.

Retention of urine may arise from injuries of the urethra or bladder, but these injuries and their treatment have been already discussed.

Another cause of retention of urine is PARALYSIS OF THE BLADDER. This arises from affections of the nervous centres. It may occur, like paralysis of other parts of the body, without any apparent immediate cause, or it may arise as a direct result from injuries of the spine. Cases of the latter class seldom do well, for the original injury leads to changes in the mucous membrane of the bladder, which, in their turn, lead to decomposition of the urine contained in it, and this again to a low form of inflammation in the coats of the bladder, which often causes a fatal result.

This is the simplest case in which the introduction of a catheter is necessary, for if there has been no previous stricture

the urethra continues in its normal condition, and there is no obstruction to the passage of the instrument. A large size of catheter should therefore be used, No. 10 or 12. It is possible, however, to create difficulties even in connection with such cases as these, unless attention be paid to the position of the parts. If the instrument be passed too far down, it is apt to get hitched on the sinus of the bulb, just in front of the anterior layer of the triangular ligament, and if it be pushed too far in the same direction, a false passage will be made through the spongy portion of the bulb. If, on the contrary, the turn be made too soon, the point of the instrument comes into contact with the pubes, on the anterior margin of the opening in the triangular ligament, and that constitutes another difficulty. The point should be directed rather towards the right side of the urethra, and bearing lightly on its upper wall, until it be pretty well back in the perineum, and then the handle gradually depressed. If any obstruction be met with, the catheter should be withdrawn a little, and then passed rather towards the opposite side. The curve of the catheter should not be too large. In introducing it, the more lightly it is held the better. It should first be guided gently, but not forced in any degree. If these points be attended to, there will be no difficulty in introducing the catheter into a paralysed bladder, provided that there be no stricture of the urethra.

PARALYSIS OF THE BLADDER does not occur so often as is supposed. Many cases so called are simply instances of atony of the bladder, the result of over-distension of its muscular fibres, and not attended with actual loss of nervous power in the organ. In many such cases the enlarged outline of the bladder may be visibly traced on the abdomen, and in most, but not all, it may be audibly traced by means of percussion. The bladder may be irritable from other pre-existing causes, therefore we must not be misled by expecting to find that the degree of irritation will always be in direct proportion to the amount of distension.

When we pass the catheter in a case of an enlarged atonic

or paralysed bladder, we are apt to be disappointed with the comparatively small stream which results. This is due to the want of contractile power in that organ, for it does not propel its contents, as a healthy bladder would do, and what little force the stream possesses is due more to the action of the abdominal muscles than to any other cause. Under frequent use of the catheter, the atonic bladder regains tone, and eventually contracts and empties itself normally. In the slighter cases of retention, the bladder should be stimulated to action by sинаpisms over the spine and upper part of the sacral region, and heat should be applied to the lower part of the abdomen. The patient should be admonished to pass water frequently, so as to prevent large accumulations in the bladder, and then it will more readily regain its power.

Amongst the most common of the causes of retention of urine are DISEASES OF THE PROSTATE GLAND. These are of great importance, and the different conditions require careful attention. There may be simple hypertrophy, or chronic or acute prostatitis, or malignant disease. Acute prostatitis is met with occasionally in young people. It is characterised by the ordinary symptoms of inflammation, one of which, the *swelling*, gives rise to an additional symptom—that of obstruction to the flow of urine. On examination by the rectum, the gland will be felt enlarged, and very tender to the touch.

What we have to deal with in connection with such a case, in the first instance, is the retention of urine, and you may well imagine that in such circumstances the passing of a catheter is attended with great pain, as well as danger, and this applies also to scrofulous disease of the prostate. If, therefore, any other means of relieving the bladder can be devised, they should be adopted. Opiate enemata and the warm bath should be tried; if these fail, the patient should be put under chloroform, and the urine drawn off with the catheter. A medium-sized catheter, say No. 7 or 8, is likely to be attended with least risk. This, if skilfully managed, will effect the desired result.

In elderly or old people, the prostate becomes enlarged and rigid. This enlargement gives rise to an altered position of the prostatic portion of the urethra, and hence to a difficulty in emptying the bladder. In such cases the retention occurs mostly in fits, and continues for about a fortnight. During these periods of exacerbation, the patient requires to have his urine regularly drawn off. At other times, during the intervals he is able to pass it without assistance—more slowly than usual, however, and generally without completely emptying the bladder. The periods of exacerbation occur generally in spring and autumn, the damp, chilly seasons of the year; they are usually accompanied by irritation of the bladder, and the urine is often loaded with phosphates and urates, together with a secretion of ropy mucus. In patients of arthritic diathesis, the uric acid is often deposited in very large quantities, as well as phosphates, and the affection often corresponds to an attack of gout.

In enlarged prostate the obstruction is not due entirely to the enlargement, but partly also to the altered position of the urethra, the axis of which is often curved and distorted by the irregular swelling of the substance of the prostate which impinges upon it. Thus also the prostatic part of the urethra, which normally is little more than an inch long, becomes dilated, elongated, and its axis altered, owing to the enlargement of the gland. The position of the bladder becomes altered, the superior fundus being elevated out of the pelvis, whilst the posterior part of the prostate itself is projected upwards within the bladder, the *bas-fond* or inferior fundus of which forms a sort of *cul-de-sac* behind the gland. Owing to this condition, the urine tends to dribble away after it has ceased to flow in a stream. In treating the irritable bladder in cases of enlarged prostate, it requires to be freely washed out from time to time, as the urine lodges in the pouch behind the gland, and becomes decomposed and ammoniacal.

In some cases the prostate gland may be enlarged on one side only, or one lateral lobe much more than the other. Or its body, formed by the two lateral lobes, may be very nearly of its normal bulk, that is, about the size of an ordinary chestnut, whilst its

central and posterior part may be altered in size, form, and direction, constituting enlargement of the third lobe. A portion of the central part of the gland protrudes, so as to form a sort of valvular projection into the bladder and over the orifice of the urethra, and, when inflammation or engorgement occurs, the urine is prevented from passing out. In some instances this projection of the third lobe is almost pedunculated in form, so that when the urine is pressed down by the contraction of the bladder, the projection is forced before it against the opening of the urethra, and closes it like a valve.

In other cases again the gland is not so much enlarged, as very dense and elongated, and the greater portion of it lying above the urethra. When this form of enlargement of the gland occurs, it becomes very much elongated, and the prostatic urethra is stretched almost to a straight line upwards, at an acute angle to the membranous portion. As I have mentioned, a larger portion of the gland-substance lies on the pubic than on the sacral aspect of the urethral canal. If we examine such a prostate from the rectum, and at the same time have an instrument in the bladder, we feel no great enlargement of the gland. On the contrary, we feel that the finger is nearer the instrument than usual, but we also feel that the gland-substance is elongated and stretches up beyond the reach of the finger.

Another condition is sometimes met with, namely, enlargement of the gland, attended with peculiar symptoms. It may occur at any period of life, but is most common in people above middle age. The symptoms supervene rapidly. There is excessive and constant pain, frequent desire to make water, and much blood is passed by the urethra. On examining by the rectum, the gland is felt enlarged, but soft. On introducing a catheter, in passing it through the prostatic part of the urethra it seems to sink through a soft mass, and bleeding, occasionally very profuse, occurs after withdrawing the instrument. There is great local irritation, the constitution sympathises, and the patient becomes cachectic. These conditions are symptomatic of fungoid tumour, or malignant soft cancer of the prostate.

In treating cases of prostatic disease, if we had merely to relieve the retention of urine, their treatment would be attended with no great difficulty. But although in most cases of enlarged prostate we have the state of complete retention occurring after exacerbations caused by cold, errors of diet, and frequently coming on at certain seasons, as in spring and autumn, yet the patients generally suffer more or less continually from irritable bladder or chronic cystitis. The bladder, in some cases, is never thoroughly evacuated, and the urine is apt to become decomposed, and to keep up or increase the irritable or inflamed state of the organ. In treating such cases, therefore, we must attend to the general state of the patient. The use of the hip-bath and warm fomentations over the abdomen are beneficial, and the urine must be frequently examined, as it should be in all cases of urinary disease.

If retention of urine be present when we are called to the patient, we must relieve that at once by the use of the catheter. We must not be thrown off our guard by the statement that an instrument has been used, and that there is no water in the bladder, as only some blood came away, for in that case we may safely conclude that the catheter has not been in the bladder, but has made a false passage through the urethra, or lodged in the dilated prostatic urethra. In some instances you may even get away a little water from this prostatic portion of the canal, which is often dilated into a small pouch, containing the urine which overflows from the distended bladder, and this urine, flowing by the catheter, might mislead into the belief that the catheter had entered the bladder. We are often told that the patient is constantly micturating, so that there can be nothing in the bladder; but in all cases we should examine the abdomen by percussion and palpation, as that will show the true state of the bladder. We cannot feel the bladder from the rectum when the prostate is very much enlarged, because it is thrown up from the pelvis; but we can always feel it from the abdominal parietes. Where there is the least doubt, we should pass the catheter and satisfy ourselves as to the real state of matters.

In most cases of enlarged prostate an ordinary catheter will answer well enough. A full-sized round-pointed catheter will enter most easily, but it must be passed carefully and gently. On coming to the prostatic part of the urethra, we depress the handle rather more than usual, so as to elevate the point of the catheter. If it be obstructed in the mesial line, direct the point to one or other side in case it be a lateral enlargement, but do not use force. An ordinary catheter, however, may not be able to reach the bladder when there is great enlargement of the prostate, and in these cases we should use the prostatic catheter, which is about thirteen inches in length, and which has a different curve from the ordinary catheter. The curve is much more abrupt, and the instrument is longer from the curve to the point, than the ordinary catheter. Its size should generally be large, No. 10 or 11 of the catheter gauge.

In cases where there is any real difficulty from great enlargement of the gland, the prostatic catheter passes much more readily, and will reach the bladder when an ordinary one may fail to do so. There is no more risk in using it than the common catheter, if it be passed properly. We must keep it bearing gently against the upper wall of the urethra, as we pass it onwards, not letting it get too far down in the perineum, hooking it up under the pubis as it were, then depressing the handle, and using very little pressure to guide it onwards and upwards. In this way the instrument may in general be readily passed into the bladder.

Another method of emptying the bladder in cases of enlarged prostate, is to use a gum-elastic catheter with a stilette. We use it with an ordinary curve at first, and pass it down into the membranous, then into the prostatic part of the urethra onwards to the obstruction. We then fix the instrument here, and withdraw the point of the stilette. This increases the curve of the catheter, and makes its point pass over the obstruction, and thus it sometimes enters the bladder, when a silver catheter will not readily pass. When there is any real difficulty, however, I think that the silver prostatic catheter is the safest and the best,

as we can guide it; though we may succeed occasionally with a gum-elastic catheter, by the manœuvre above described; I occasionally use it when, from previous experience in a case, I know that there is a valvular obstruction from projection of the third lobe of the prostate.

The vulcanised india-rubber catheter is very useful for some purposes. If we do not withdraw a catheter in prostatic disease, as we may sometimes be obliged to do, especially in country practice, where we cannot always visit our patient frequently, the vulcanised india-rubber catheter is most suitable, as it can be left in the bladder with much greater safety than the gum-elastic or the silver instrument. Again, whilst it is not always safe to allow patients to use a catheter themselves in prostatic disease, yet with a vulcanised india-rubber catheter, from its softness, they can do themselves no harm even if they fail in getting the instrument into the bladder. It should never be used, however, when there is any laceration of the urethra. This instrument must be introduced bit by bit, because, if we take too much of it in hand at once, it bends upon itself. The soft india-rubber catheter should have considerable resistance at the point, and the eye should be small, so as to obviate the bending of the point on itself near the eye.

Besides the mere mechanical treatment in prostatic disease, I have already said that we must also attend to other things. Having relieved the urgent condition of retention, we then direct the patient to take some strong decoction of *Pareira brava*, or the infusion of *Triticum repens*, to allay irritation of the bladder and urethra. If the urine be loaded with mucus, the infusions of buchu or uva ursi should be given either alone or with the pareira. We must also examine the urine to see whether it is phosphatic, or if it merely contains phosphates from the prostatic irritation; and we must be careful to make this examination occasionally at short intervals. The first urine drawn off after retention will probably be ammoniacal; but if it be generally acid, a very small quantity of alkali, such as potass-water, should be taken as a drink in addition to the vegetable infusion. The

tendency in prostatic disease, however, is for the urine to become alkaline, and therefore we should be very cautious in giving alkalies too freely. We often require to give some nitric or nitro-muriatic acid to relieve the irritable state of the bladder caused by the presence of phosphatic or ammoniacal urine. In the earlier stages, and when no uræmic symptoms are present, the use of opium will sometimes relieve the pain and irritation, and the use of leeches to the verge of the anus, with warm fomentations to the perineum, and sinapisms over the loins or sacrum, will occasionally relieve the congestion of the prostate. Iodide and bromide of potassium have been much used, and lauded as not merely relieving symptoms, but as diminishing the enlargement of the prostate, but I cannot say I have ever seen much benefit from their use.

In the more advanced stages of prostatic disease, attended with constitutional disturbance, we must be very cautious in giving opium, for there is a tendency to uræmia, and the use of that drug is attended with danger, for the symptomatic coma of uræmia is very similar to that of opium-poisoning, and even a small opiate may determine an unfavourable issue, by increasing the tendency to coma. Henbane is preferable in such cases, when we require to use an anodyne. The means I have mentioned relieve the congestion and the irritable state of the bladder and kidneys, and then, in most cases, by the use of simple diluents, or of acid or alkaline drinks, according to the state of the urine, the general condition of the urinary organs is improved. In short, we must attend to the general condition of the patient. The diet should be nutrient, but not too stimulating. The best stimulants are the light Rhenish wines or claret, for they do not tend to irritate the bladder as most of the red wines do; they also prevent the urine from becoming alkaline, and are slightly astringent.

If there be any malignant disease of the prostate, or if, in any case, there be much discharge of blood from the bladder, gallic acid, in 5-grain doses every three or four hours, may be given with very great advantage. As a prophylactic in some

cases of prostatic disease in gouty patients, I have found the beneficial effects of colchicum wine in small doses of eight or ten drops, taken at bed-time for a week or so, about the time when the exacerbation of the disease generally shows itself, or when there are any uneasy symptoms, as it will often ward off the attack ; and, indeed, fits of retention are sometimes completely prevented by this remedy.

In cases of retention from enlarged prostate, when we are foiled in passing the catheter, how are we to draw off the urine ? In such cases it has been proposed to puncture the bladder from the rectum ; but in any diseased prostate, where puncture would be warrantable, we cannot puncture from the rectum, because the bladder is raised out of the pelvis by the enlargement of the gland, and we are unable to feel or reach the part of the bladder above the prostate, where it is uncovered by the peritoneum. Hence, if puncture of the bladder is to be adopted, it must be performed in the linea alba, immediately above the pubes. In cases of enlarged prostate the bladder is not so likely to subside behind the pubes as in the high operation for stone, because it is kept in its elevated position by that condition of parts ; and here, therefore, we may introduce a trocar and canula with comparative safety, and then pass a large gum catheter through the canula, and leave it in the bladder. The opening so made may always continue pervious, as I have known in one case, where the patient makes water through the anterior abdominal parietes. In such cases, a continuous mucous surface forms from the bladder towards the skin in this locality. The operation, however, is not a satisfactory one ; it is attended with some danger, and there are few who would consider it comfortable to be compelled to micturate through the front of the abdomen. Besides, the operation is not necessary, for I think that with care and perseverance we should always succeed in passing a prostatic catheter, if not an ordinary one. But, if the natural passage be completely closed in, so that we cannot introduce an instrument, it is preferable to make a false passage through the prostate. A new and more direct canal

is thus formed, and great benefit experienced. By passing a catheter, and guiding it carefully in the first portion of the prostatic part of the urethra, then, by attention to the axis of the pelvis, making it pass into the bladder, by forcing it through the substance of the prostate, and keeping it in for forty-eight hours, a new canal will be opened in a much more direct line—the urine will continue to pass through it, and the canal will remain permanently open. This method should only be adopted when we cannot pass a catheter through the ordinary passage. It is safer and more satisfactory in its results, however, than puncturing the bladder above the pubes, and is much more likely to relieve the retention permanently ; and I believe it to be safer than continued efforts to find the natural canal, when there has been much rough treatment with the catheter.

LECTURE CXXII.

Retention of Urine from Stricture of the Urethra—Spasmodic or Congested Stricture : Treatment—Organic Stricture—Anatomy of the male Urethra—Pathology of Urethral Stricture—Morbid Changes in other parts of the Genito-urinary Organs arising from Stricture—Fistula in Perineo.

PERHAPS the most frequent and dangerous cause of retention of urine is contraction of the canal of the urethra, leading to obstruction, and constituting STRICTURE OF THE URETHRA. The urethra may be contracted either temporarily from some irritation leading to spasm and engorgement, or from true organic stricture, resulting from inflammatory affections, such as gonorrhœa, leading to consolidation and contraction in the parts. To the former of these kinds of constriction—the functional, or spasmodic, or engorged stricture—the term stricture should scarcely be applied. It is a mere temporary contraction, for there exists no real stricture. It arises in most cases from some irritation about the neck of the bladder, as in gonorrhœa, when the prostatic part of the urethra becomes irritable and the patient is constantly passing water over it, or from exposure to cold, or after some debauch. The bladder becomes distended, and the patient cannot pass water at all—the penis is semi-erect—the spongy part of the urethra is engorged, and there is a feeling of contraction and irritation, and intense pain and spasm about the rectum and neck of the bladder, with spasmodic attempts to make water—the patient striving in agony to pass a few drops of urine. In such cases the patient may suffer to such an extent from the retention, that we may require at once to use a catheter to relieve him ; we must, however, be very cautious in using it, and employ means to allay the pain and irritation when passing it

In a very large majority of cases, however, the symptoms of retention are not so urgent. The pain and the desire to pass water are very marked, but the real distension of the bladder is not great. In such cases, where we have to deal with inflamed and congested and irritable parts as causing the obstruction, the introduction of an instrument really keeps up the irritation. We should therefore, if possible, avoid using a catheter, and rather put the patient in a warm bath, and give an opiate enema. When the patient is in the bath, pour cold iced water on the penis, and the spasm will often pass off, and the urine come away without the necessity of passing a catheter. Then, by attention to the general health, giving some alkaline diluent drink, and putting the patient on antiphlogistic regimen, the tendency to the retention is overcome. These means should always be used first, for even if the retention still continues, and the use of a catheter becomes necessary, they render the introduction of the instrument easier. When these means fail to relieve the patient, and we require to use the catheter, we should give the patient chloroform, and apply cold or iced water to allay the irritability of the penis, which is engorged, congested, and consequently semi-erect, thus rendering catheterism difficult. In such cases there is not merely spasm, but also engorgement of the textures, and the catheter is very liable to cause bleeding, for the swollen mucous membrane is very apt to be lacerated, and the slightest abrasion in this state causes profuse bleeding from the urethra. We then take a No. 7 catheter with a rather short curve, dip it in warm water, oil it well, and pass it carefully along the urethra as far as the bulb. If we meet with any obstruction, we should withdraw the point a little, draw the penis forward upon the instrument very gently, and it will then pass in; but the condition of the prostate and neck of the distended bladder will cause some obstruction at the vesical entrance, for the parts there are very much swollen, the neck of the bladder is elongated, the axis of the membranous portion of the urethra is consequently altered, and we therefore require more than usually to depress the handle of the instrument to make

the point enter the bladder. After once relieving this organ, we must try to avoid using the catheter again, as every introduction of it excites fresh irritation. We should employ an opiate suppository and give acetate of potash, or aerated potash water, or camphor mixture, and apply warm fomentations or poultices above the pubes. When there is much engorgement we may apply leeches to the verge of the anus, to relieve the fulness of the prostatic veins, as this is attended with marked benefit in relieving the local irritation. The regimen should be strictly antiphlogistic.

True ORGANIC STRICTURE of the urethra is one of the most important of surgical diseases, and one which, perhaps, more than any other, requires skill, experience, and tact in regard to diagnosis and treatment. This morbid condition may be defined as a diminution of the calibre of a portion of the canal of the urethra, due to the deposition and organisation of inflammatory products, either into the textures surrounding the mucous canal or on its free surface, leading to permanent and even progressive contraction, attended with more or less obstruction to the passage of urine.

To give distinctness to our views as to the usual sites of organic stricture and other important points in relation to its diagnosis and treatment, I must advert very briefly to the anatomical divisions of the urethral canal. If we trace this canal as it emerges from the bladder, we find it passing through the substance of the prostate gland, from above, downwards and forwards. This part of the urethra is wide, and closely connected with the substance of the prostate ; its floor presents foramina in which are openings of the prostatic ducts, and in the centre we have a raised line, terminating anteriorly in the verumontanum, in which the common ejaculatory ducts of the vesiculæ seminales and vasa deferentia open ; so that the mucous membrane is pretty firmly attached to the adjacent prostate. This prostatic portion of the canal is about 1 inch and 2 lines in length. The membranous portion of the urethra is the shortest portion of the

canal, and traverses the interval between the two layers of the triangular ligament in a somewhat oblique direction from behind forwards, and from above downwards. If we measure this portion, where it lies between the layers of the triangular ligament, its length is 6 lines, or if we regard it as extending from the apex of the prostate to the bulb of the urethra, its length is $7\frac{1}{2}$ or 8 lines. The portion lying between the layers is wide, dilatable, and only loosely connected with the vascular and muscular tissues which surround it. Where it traverses the opening in the ligament it is closely attached to that resistant structure, is narrowed in passing through the opening, and receives an expansion of the fascia which is continued over the bulb, and gradually lost upon the spongy portion. When the urethra emerges from the opening in the triangular ligament, it comes in contact, and becomes intimately connected throughout its course, with a peculiar vascular erectile tissue, which, commencing in a pendulous or bulbous form near the urethral opening in the triangular ligament, terminates by forming the glans penis. This spongy portion of the urethra, as it is termed, is by far the longest part of the canal, its usual length being $6\frac{1}{2}$ inches, but it varies not only in different subjects, but according to the state of the penis, as will be seen by reference to the results of my measurements of the urethra. The mucous canal, corresponding to the spongy texture, presents some points worthy of our notice in reference to their surgical bearings. At the part where it corresponds to the bulb its lower wall or floor dilates into a sinus, which lies farther back in the perineum than the urethral opening in the triangular ligament, and hence an instrument has a tendency to pass into this sinus of the bulb, and, in such a case, when the handle is depressed the point hitches in the sinus below the margin of the opening. Into this sinus also the ducts of Cowper's glands open, a fact which we require to keep in mind in reference to some forms of perineal fistula. Along the whole mucous surface of the urethra are numerous small lacunæ. Near the orifice the mucous surface presents a very large lacuna, which sometimes gets the blame

of entangling the point of the catheter. Where the urethra opens in the glans penis, it is contracted and compressed laterally. The calibre of the canal at the orifice is even smaller than where it passes through the triangular ligament, so that it may serve as a gauge for the size of instrument which should pass easily along the rest of the canal, unless there be some abnormal cause of obstruction. To ascertain the exact measurements of length of the different portions of the canal to which I have alluded, the plan adopted—as combining the advantage of anatomical precision while at the same time the relations are maintained exactly as during life—was the following: The prepuce being well drawn forwards over the glans penis, two harelip needles are thrust through it near its orifice, and behind the needles a strong waxed ligature is firmly tied so as completely to constrict the prepuce in front of the glans penis. The bladder and urethra are then to be moderately distended with alcohol, injected slowly by the ureter. After the textures have by this means been hardened, a careful section of the bladder and urethra can be made without disturbing the natural relations or curvature of the canal, and thus not only may correct measurements of the whole length be obtained, but the definite length of the spongy, membranous, and prostatic portions, their relations to each other and to surrounding parts, together with their depth from the surface of the perinæum, can be accurately determined. I have made many such sections, and have taken casts from them. In very fresh, firm subjects, the section, as far as regards the urethra, can be well enough made without hardening with alcohol. We may here subjoin the results of the measurements so taken. These were taken by means of a piece of thin waxed cord laid along the canal, and following its curve.

I. Measurements of urethra ; parts in natural condition, penis resting on right groin.

Total length of urethra from meatus urinarius externus to anterior border of uvula vesicæ, 7 inches $11\frac{1}{2}$ lines, or almost 8 inches.

Spongy portion.—From meatus externus to commencement of mem-

branous portion at its entrance into the anterior layer of triangular ligament	6 inches 4 lines
Membranous portion.—From its entrance at the anterior to its exit at the posterior layer of the triangular ligament, half an inch, or	0 „ 6 „
Prostatic portion	1 „ 1½ „
Total length	7 11½

Measurement of the walls, membranous portion between layers of triangular ligament {	Upper wall	5 lines.
	Lower wall, $\frac{3}{8}$ inch, or	4½ „

II. Measurements of urethra ; penis previously injected with wax, so as to represent the erect condition.

Total length of urethra, from meatus externus to anterior border of uvula vesicæ, 9½ inches.

Spongy portion to orifice at anterior layer of triangular ligament, 7⅞ ins.

Membranous portion ⅘ „

Prostatic portion 1⅛ „

Total 9½ „

The exact measurements of the width of the urethra are very difficult to obtain ; our results can be but approximative. The best plan is the old one, of taking casts by filling the bladder and urethra with wax or fusible metal, and so obtaining the width of the canal at different points when dilated by a moderate and equal fluid pressure.

Finally, as regards these anatomical hints, I would merely remind you that besides voluntary muscles related to the urethra at different parts of its course, modern investigations have shown that the mucous membrane is closely connected by its sub-mucous tissue with involuntary muscular fibre in every part of its course, not existing, however, in equal quantity throughout, and at some points interlacing with portions of the yellow elastic tissue.

In regard to the general course of the urethra,—if we look at the canal when the penis is pendulous, we see it has a double curve like the letter S, but the anterior curve is effaced when we stretch the organ, as in introducing a catheter, and then there only remains a very gentle curve from the bulb backwards and upwards through the membranous and prostatic portions of

the canal to the bladder ; but the direction of this curvature is liable to change, in consequence of alteration in the size of the prostate, or from dragging and elongation of the parts, consequent on great distension of the bladder.

If we now examine pathological specimens of cases of stricture of the urethra, we find that two portions of the canal are almost exempt from this alteration. I have never seen, and do not know of, a single specimen of stricture situated in the prostatic portion of the canal, and strictures of the membranous portion are very rare indeed, except as the result of wound or injury. I have not as yet, in any collection I have examined, been able to find a specimen of organic stricture in that part of the membranous portion which lies free between the layers of the triangular ligament. Practically, therefore, we may say that strictures are almost limited to the spongy portion of the urethra, and perhaps the point of junction between it and the membranous portion at the opening in the anterior layer of the triangular ligament. If we examine the parts of the spongy portion of the urethra where strictures are usually situated, we find, that by far the most frequent site of stricture is in what may be termed the bulbous portion, extending for about an inch in front of the bulb back to the opening in the ligament, the most frequent site being about three-fourths of an inch in front of the pendulous bulb. The next most common site of stricture is from an inch to two inches from the orifice of the urethra ; whilst the third, almost as common as the last-mentioned site, is immediately in front of the scrotum, nearly corresponding to the flexure of the penis when pendulous. The statement frequently met with in surgical works, that the most usual site is in the membranous portion of the canal, is the result of an indefinite idea of its position when passing an instrument in the living subject.

The pathological condition, as already defined, consists essentially in the deposit and organisation of new material, causing contraction or obstruction of the canal. The morbid

condition, however, is so modified by the position and extent of the deposit, and consequent alteration in structure, as to give rise to the different forms of stricture. These may be classified under two heads—1st, Contractions of the canal of the urethra caused by plastic deposit external to the mucous membrane into the submucous tissue, or involving the other textures and causing, to a greater or less extent, in length and depth, consolidation of the spongy erectile structure; 2d, Contractions or obstruction of the canal due to the deposit and organisation of plastic material on the free or internal surface of the mucous membrane, whether in the form of lateral folds of false membrane, thread-like bands of lymph, or false membrane stretching between the surfaces, or projecting wart-like masses.

Strictures arising from organised plastic deposit on the submucous aspect of the canal are by far the most frequent. The plastic lymph causing the contraction may be very limited in breadth, but may be deposited so as to include the whole circumference of the canal at the affected point; and as it becomes consolidated and organised, it forms a firm circle round the exterior of the mucous canal, constituting what is termed the annular stricture. This form of contraction may occur at any part of the passage, but is most frequently met with in strictures situated in the anterior regions of the urethra, and especially in those about two inches from the orifice. In such circumstances we can feel a little hard mass from the exterior; and when a solid instrument is passed fairly through such a contraction and along the urethra beyond, the narrow ring of consolidation is very distinctly defined, and can be felt by the finger. On examining the constricted point in a morbid specimen of this nature, we find the submucous tissue, and also frequently the spongy texture, consolidated and altered by the new material. On trying to raise the mucous membrane by dissection, we find it firmly adherent at the constricted point, and under it a somewhat flattened band of white fibrous tissue, which is usually very elastic and resilient. In other instances, as in strictures near the bulb, the new material generally involves a greater extent of

the textures external to the canal, and is often thrown out irregularly so as to impinge upon the canal laterally and distort the passage. The consolidation of texture arising from the plastic exudation may extend for some lines in length, and is usually more solid and resistant and less resilient than the annular form. In many cases the consolidation and contraction are pretty equally distributed around the canal, merely narrowing its circle; but in others, they take place so irregularly, as not only to alter the direction of the canal, but to cause its mucous surface to project irregularly, and thus render the passage of instruments very difficult. In old-standing contractions of this kind, the consolidated structure is very firm and unyielding, and when divided with the knife, it cuts with the crisp sensation of the section of cartilage; and such old contractions are often spoken of as cartilaginous stricture.

The forms of stricture included under the second head, viz.—Obstructions of the canal from new formations arising from plastic deposits on its free surface are much less frequently met with. The old surgeons used to speak of stricture as always arising from the presence of caruncles or warty projections on the interior of the urethra. Very probably they supposed that the obstruction was caused by warty excrescences, such as they would often see arising from the mucous lining of the prepuce in cases of gonorrhoea, which is so frequent a cause of stricture, and they might infer that a similar state of matters existed in the interior of the canal. In reality, projections from the free surface of the urethra, whether in the smooth polypoid or warty forms, are very rarely met with; less frequently perhaps than in any other mucous canal. The projection of folds of false membrane of a crescentic form, stretching along and attached to the sides of the canal, are sometimes met with. The false membrane, closely resembling the mucous lining, is usually attached by its convexity, and stretches from the floor of the urethra along the side of the canal, the concavity of the fold looking towards the orifice of the urethra, and not unlike a very large lateral lacuna. This form was spoken of by Sir Charles

Bell as one kind of bridle-stricture, but I think the term valvular expresses its appearance better. The true bridle-stricture is of very rare occurrence, and consists of a thread-like band of organised lymph or false membrane stretching across the course of the canal from one point of its circumference to another, attached at each extremity, but free in the middle of its course.

The term resilient or elastic stricture is used to express a condition which may be present in any of the forms of stricture arising from alteration in the submucous tissues—those included under the first head. It is recognised chiefly by its vital characters. When an instrument is fairly passed through the contraction, it dilates or yields so as to allow a rapid increase in the size of the instruments passed. Thus, in some cases where a No. 3 at first is passed with difficulty, when once it has been passed, 4, 5, and 6 may be passed in succession; but three or four days afterwards No. 3 is found to be grasped as tightly as at first. The new organised material presents a white fibrous texture, and is found to possess great elasticity and resiliency. I have said it may occur in any of the submucous forms of contraction, but the annular stricture is that in which this peculiar and troublesome condition is most generally met with.

Besides the pathological states of the urethra itself, we require to consider the morbid alterations of other organs which arise in connection with and in consequence of the urethral disease. Thus, even in its earlier stages the testicle may become painful or swollen in consequence of the sympathetic irritation of the prostatic portion of the urethra; and in unhealthy patients sub-acute suppuration may even take place. In bad strictures of old standing the prostate gland frequently suffers. We often find it the seat of multilocular abscess. Its substance is sometimes entirely destroyed, and, its proper fibrous capsule thickened, forms the boundary of a cavity containing foetid pus, through which the canal of the urethra dissected bare passes, and with which it in general communicates by one or more ulcerated openings. In such cases the vesiculæ seminales are also often distended with glairy and foetid purulent matter.

But whilst the prostate is subject to this state of disorganisation, it is very rare to meet with enlarged prostate in combination with tight or irritable stricture; at least such is the result of my observation after a very large amount of experience in the treatment of bad stricture cases during the last thirty years, and after having examined many collections of morbid specimens. It might, perhaps, be possible to account for this, but, without theorising, I content myself with stating the fact that, though I have had occasion to treat very many bad strictures in old men, and whilst I have often met with the serious alterations mentioned above, I have rarely found the prostate as much increased in bulk as it usually is after fifty years of age, and on two occasions only have I found chronic enlargement of the prostate so great as seriously to complicate catheterism in retention. In one of these, after passing a No. 3 catheter through the stricture, I found that, from the great enlargement of the prostate, and elongation of the prostatic portion of the canal, the small catheter could not reach the distended bladder. I forcibly dilated the stricture with an old-fashioned conical catheter, and then passed a No. 7 prostatic one into the bladder, and retained it there for thirty-six hours. In the other case the patient had laboured under stricture for nearly fifty years. He was seventy-six years of age, and the prostate was felt enormously enlarged; but he was labouring under complete retention, with abscess in the perineum. I opened the abscess, having first passed a small grooved stricture-staff through the contraction, and then divided the stricture, and, by using a large and long gum-elastic catheter, I relieved the bladder. Both cases did well; but these, as I have said, are the only instances in which I have met with such a complication. The membranous portion of the urethra, as it yields more readily than other parts of the canal, is always very much dilated in cases of tight stricture.

The bladder itself is always more or less affected in cases of stricture, and in bad cases very seriously. Owing to the obstruction it has to overcome in evacuating its contents, its muscular coat becomes excessively developed, the enlarged fasciculi of muscular

fibres projecting the mucous coat and giving rise to the irregular appearance of its internal surface, termed the Fasciculated Bladder, a condition also met with in other morbid states, such as prostatic disease and chronic irritable bladder. This thickening or development of its muscular coat, if accompanied, as it generally is, by chronic irritation of the mucous membrane, leads to contraction of the cavity of the organ, so that its capacity for containing fluid is diminished. When the contraction of the urethra is very tight, and the bladder not so irritable, we sometimes find that the capacity of the organ is greatly increased, whilst at the same time the muscular coat is much developed.

In other cases the increased capacity for retaining urine takes another form. Pouch-like portions of the mucous membrane are protruded between the fasciculi of the muscular coat, forming cysts, some of which are occasionally found even of greater capacity than the bladder.

In most cases of bad stricture the ureters and kidneys are to some extent affected. In nearly all cases the ureters are somewhat dilated ; but in certain instances the dilatation of the ureters is enormous, and in such cases the pelvis of the kidney and the infundibula are also distended, and the secreting portion of the gland compressed, so that the kidney presents the appearance of a cyst. This state, though in a less degree than just described, is by no means uncommon in old stricture cases, though the urine secreted during life may have given little or no indication of organic change. Various other morbid conditions of the kidney are found in cases of stricture more or less directly connected with it,—granular disease, pyelitis, multiple abscesses in the cortical substance, and in some very bad old strictures, I have found both kidneys much enlarged, softened, and broken up into granular and filamentous matter, as if they had been decomposed by maceration.

The irritation produced in contiguous textures by the presence of stricture not unfrequently leads to the formation of abscesses in the perineum, which, unless opened early, are liable to ulcerate

into the urethra, behind the contracted part, and to burst externally; then, owing to the urine finding more easy vent through the adventitious opening than through the contracted urethra, a fistula in perineo results. When this condition occurs, fresh abscesses form from time to time, and new fistulous openings, through which the urine dribbles off. In many instances we find four or five such apertures, some opening on the scrotum, others in the perineum, and others towards the hips. There is great surrounding consolidation of the perineum, and when the patient makes water, a small stream is ejected through each aperture, and very little passes through the urethra. On examination of such a case after death, we almost invariably find that, however numerous and however distant the external apertures of the fistulæ may be, they all converge to a common fistulous canal, communicating with the urethra behind the stricture. In old cases these fistulous tracks are lined by a smooth structure, resembling mucous membrane; and where no proper means have been used, the contracted part of the urethra may have become absolutely impermeable from disuse.

LECTURE CXXIII.

Symptoms of Urethral Stricture—Secondary effects on the Digestive Functions and on the Nervous centres—Positive Diagnosis of Organic Stricture—Treatment of Retention of Urine, arising from Tight Stricture—Curative Treatment by Vital Dilatation—Dupuytren's plan of Vital Dilatation.

A CONSIDERATION of the various morbid conditions which I have mentioned will show you that in the diagnosis and treatment of stricture of the urethra we have generally to deal with more than the mere local alteration, and it should also impress you with the necessity for careful examination into the state of the different organs likely to be affected, as modifying the plan of local treatment which we may employ ; and, besides these more direct complications, we have the less direct effect of the disease on the digestive organs and nervous system, which require our most serious attention.

The causes of urethral stricture are various—injuries of the urethra and perineum ; inflammation of the canal, produced by any cause ; ulceration from applications of caustics to the urethra. By far the most common cause, however, is the peculiar form of venereal inflammation, gonorrhœa, and the succeeding gleet. I should say that about 96 out every 100 cases are due to gonorrhœa and its results.

The symptoms of urethral stricture, depending on the local condition, are gradual diminution of the stream of urine, till at last it comes only drop by drop, or ends in complete retention. The diminution in the size of the stream, however, is so very gradual, that the patient does not at first notice it, and insensibly gets accustomed to this state of matters, until his attention is attracted to it by some other circumstance, such as the length of time he requires to empty the bladder, and the straining which is necessary to effect the emission of the urine.

Very commonly the thing that attracts his attention is, that after he has finished micturition and arranged his dress, he finds the urine dribbles away and stains his linen. At other times, he notices the twisted or forked appearance of the stream ; not unfrequently irritability or swelling of the testicle causes him to consult the surgeon, and leads to the discovery of the real cause of his symptoms. The condition of complete retention is, of course, too urgent to escape notice, and this state may arise at a comparatively early period of the disease ; because congestion or irritation from any cause, when superadded to organic contraction, may occlude the passage temporarily, and in all cases of retention from organic stricture these causes are in operation.

The symptoms of disordered functions of the digestive organs, arising indirectly from, or connected with, urethral stricture, are generally present in cases of tight contraction. Mr. Abernethy drew attention to this, and also to the fact that disordered functions of other organs, by exciting irritation of the urinary organs, might simulate some of the symptoms of stricture. These views, though perfectly true when properly understood, led at one time to very mischievous practice. Unfortunate dyspeptics who, under a series of leading questions, were made to confess that they occasionally felt uneasiness about the urinary organs, were at once subjected to a course of bougies, and they were fortunate if they escaped without having real mischief excited in the urinary passage. From what I have seen of patients who have been under treatment for stricture, I fear the most extended charity will not allow me to believe that the practice alluded to has been altogether abandoned. I have been frequently consulted by patients, who had for weeks or months been undergoing gradual dilatation up to No. 3 or 4, but in whom I found that a No. 9 catheter passed without let or hindrance into the bladder.

There is one indirect effect of bad stricture to which I would draw your attention, as of importance in regard to its diagnosis, prognosis, and treatment—I mean, the secondary effect produced on the nervous centres of the lower part of the medulla spinalis, in consequence of the long-continued irritation of the nerves

supplying the bladder and adjacent pelvic viscera, giving rise at first, by reflex action, to functional, but, unless checked, ultimately leading to organic alteration in the medulla spinalis. The symptoms of this condition are very alarming, simulating as they do those of incipient paraplegia, and in some cases culminating eventually in that condition. Thus, we have neuralgic pains in the lower extremity, and also in the lumbar region, cramps or spasmodic twitches of the lower limbs, especially when in bed, a feeling of dull weight and constriction over the lower part of the abdomen, and gradually increasing weakness of the lower limbs. It is of course quite possible that chronic disease of the medulla spinalis may occur coincidently with stricture or vesical affection; but, in the cases I refer to, the symptoms are produced, in the first instance, reflexly, and depend, as I have said, on long-continued irritation of the branches of the lumbo-sacral plexus, and also of the organic nerves of the hypogastric region. The chronic congestion of the vessels of the pelvis and neighbouring parts will also conduce to give rise to this condition. When these symptoms, therefore, arise in cases of stricture, we are, I think, warranted in forming a more favourable prognosis, as the morbid conditions with which they are connected are, in the first instance, merely functional; and if the treatment of the local affection—the stricture—be successfully carried out, and means taken to allay the irritation of the urinary organs, and to relieve congestion, the alarming symptoms will disappear, and organic changes in the nervous centres will thus be prevented.

In regard to the positive diagnosis of urethral stricture, that can only be arrived at by examination by instruments, when carefully and methodically conducted, for all the symptoms of stricture, whether constitutional or otherwise, depending on the local obstruction, may arise from other causes. In conducting an exploration with instruments, I have said it must be carefully done, and on some fixed principle, for otherwise it is quite possible to be misled by such an examination. Thus, if taking for granted the statements of the patient that he has a stric-

ture, or, influenced by retention of urine being present, the surgeon at once begins by trying to pass a small catheter, he may not succeed, but if he at last manages to get a No. 1 or No. 2 into the bladder, he may conclude that he has had to deal with a tight stricture. In such circumstances the diagnosis is not certain; the operator has probably been making difficulties for himself, and it is not unlikely, that if he had begun with a No. 7 or No. 8. catheter it would have passed with less difficulty. In all cases of a first diagnostic exploration, the surgeon should use a medium-sized catheter. If there be no organic stricture there is less risk of injuring or irritating the mucous membrane, and the instrument will pass more readily than a small one. If there be an organic stricture, the point of arrestment will serve so far to indicate the site of the stricture. So far back as 1844 I devised a bougie with a probe point, about the size of an ordinary pocket-case probe, the stalk increasing very gently and gradually in diameter towards the handle; this instrument I have found of great use in passing through tight strictures, and in determining in some measure the site and extent of the contraction. But the instrument which I consider affords the surest diagnostic evidence is the probe-pointed steel stricture-staff, such as is used in perineal section. The small probe-pointed portion of the staff, which is similar to the bougie just mentioned, will more easily pass than any other instrument through a tight stricture; whilst the sudden swell of the thick portion of the staff is of course arrested by the organic stricture, and defines exactly the anterior part of the contraction; whilst, if the case be not one of true stricture, whenever the probe point passes, the thick portion of the staff follows without difficulty, and can be felt from the rectum, so as to settle completely all doubts on the subject. We must, however, be careful to examine from the rectum, and ascertain that the thick part of the staff has passed into the membranous portion of the urethra up to the prostate; because, when the narrow part of the instrument passes a short stricture, and enters the bladder, the thick portion can be depressed by pushing the contraction before it; but then, by means of the finger in the

rectum, we can feel that the narrow part of the staff only has passed, and that the thick portion is still arrested in the perineum. With these precautions, and using great gentleness in passing the instrument, I consider this method of diagnosis affords us absolute certainty as to the existence and site of an organic stricture.

I now proceed to speak of the treatment of stricture, and we must consider this under two aspects. *First*, the treatment when the emergency of retention of urine has occurred in consequence of organic stricture; *secondly*, the different methods employed for the radical cure of the disease, or the treatment of stricture properly so called.

There are few emergencies in surgery attended with more urgent symptoms, or requiring greater skill, experience, and determination, tempered with gentleness in manipulation, than retention of urine arising from tight organic stricture; and whilst I may be able to give you some hints for your guidance, founded on a considerable experience in such cases, I feel at the same time, that this is one of those subjects where many important advantages of experience are not communicable, but must be attained by each one for himself.

To begin,—In dealing with cases of retention from organic stricture, I would advise you to hold as an axiom, that, wherever the patient has, up to the time of the attack, been able to pass water by the urethra, in however slender a stream, there must be a passage along which you should be able to pass an instrument into the bladder. In regard to absolutely impermeable contractions, I know that, pathologically speaking, they do exist. I have two specimens in my own collection, but they are excessively rare; and in regard to your practice in the case of retention, you will do well to dismiss the idea of impermeability from your mind, and adopt the axiom I have recommended. Like the word “impossible,” the term impermeable, in relation to stricture, is apt to lead to failure by preventing or weakening effort, and leading to a want of determination and perseverance, founded on a certainty of success if these efforts be properly di-

rected. I once heard an old surgeon, who had had great experience in treating stricture, and witnessing the treatment of others, say, that he believed the success of some surgeons, in relieving retention where others had failed, depended on "patience, perseverance, and sweet oil,"—a quaint way of expressing what I believe is very true. Without at all disparaging the last very useful item, "the sweet oil," I would specially direct your attention to the combination of patience with perseverance. It is not by mere dogged, determined perseverance, persisting in the use of instruments, that you will succeed. You must, under trying circumstances, patiently consider the probable causes of difficulty, keep your temper from getting ruffled, and never let it lead you into forcible or unmeaning manipulations, otherwise you will increase your difficulties by making false passages. The instrument must be managed gently, held lightly, and guided by the finger of the left hand, introduced into the rectum. No force should be used. But then, you may very well ask, What do you mean by no force? Can you pass an instrument along the urethra, through a tight resistant contraction, without some degree of force? and how much, then, is justifiable? Well, I cannot answer the question by saying how many pounds weight of power would be safe, and how much would do harm. So far as I can communicate my own sensations as to force, I say that, in using the catheter or other instrument in such cases, I hold its flat handle lightly between my finger and thumb, and merely communicate sufficient force to guide it along the canal. When I meet with an obstruction—if I feel the point of the instrument pushing against it—I use no force to propel it; on the contrary, I rather leave off all pressure, and, if the instrument feels loose, then I know it had not entered the contraction, but had been pressing against or hitched upon some fold of the mucous membrane, and that if I had persisted in pressing it on forcibly, I would have made a false passage. If, on the other hand, on withdrawing the guiding pressure, I feel that the instrument is held or grasped—it has entered the contraction, and if that be tight and of firm consistence, or of some lines in length, then a

moderate and sustained degree of force is warranted, and necessary to pass the instrument onwards to the bladder.

I would here advert to another point in reference to passing the catheter in tight strictures—namely, that when the instrument has fairly passed through the stricture, it is sometimes difficult to guide the point through the membranous and prostatic portions of the canal, from the firmness with which the body of the instrument is held in the stricture, and hence the use of the finger of the left hand being introduced into the rectum to guide the point of the catheter in its onward course.

In all your manipulations in such cases, you must keep before you the natural direction and course of the urethra, in conjunction with the anatomy of the parts, both in their healthy and morbid states; but the tact in using instruments, and various manœuvres by which difficulties are sometimes overcome, can, I believe, only be learned by each one for himself, as the result of experience; and on such experience, and the resources which he has in himself, will depend the greater success of one man than another in the treatment of stricture. In difficult cases of tight unyielding stricture, the probe-pointed steel stricture-staff is often of service to make way for the silver catheter, which, when of small size, has not sufficient rigidity to enable us to direct it so readily through the contraction and onwards. My colleague, Dr. Watson, uses a probe-pointed steel catheter. I never myself found occasion to use it, but I can conceive it of service in some cases. In most cases, however, when there has been great difficulty in passing a small instrument in cases of retention, I think it advisable to leave in the catheter, and should prefer a silver to the steel instrument for that purpose, and I confess to a dread of the temper of a hollow steel instrument, so that I have in very difficult cases proceeded by passing a steel staff, and then followed it by the silver catheter, or else performed perineal section at the time, and emptied the bladder by a full-sized gum catheter, and left it in for some hours. The latter method is rendered imperative in some cases by the viscid or

purulent state of the urine, which would soon block up a small silver catheter.

I have hitherto directed your attention principally to the method of dealing with the mechanical obstacle caused by the contraction. I have done so because in cases of retention from organic stricture we cannot afford to lose time. We must, however, recollect that in all such cases congestion and spasm from irritation are also present, and we should therefore use means to allay them, so far as that can be done, without risking delay in passing instruments. An opiate enema may be administered, and cold or iced water applied to the penis and perineum to relieve congestion, and chloroform may be used before resorting to instruments. But none of these measures are to be trusted to by themselves, because the difference between this and spasmodic stricture is, that here the spasm and irritation are due to and kept up by the organic disease, and will not yield until the catheter has been passed. A warm bath often relieves the uneasiness of the patient, and he sometimes passes a little urine whilst in the bath ; but I repeat that no time should be put off in trying such measures when retention is urgent.

In dealing with old tight strictures, when retention is not present, and where there is therefore no absolute necessity for at once passing an instrument, we should take measures to allay irritation, and prepare the patient for strictly surgical treatment by attending to the state of the bowels, the character of the urine, and other general conditions, as well as by using the hip-bath and anodyne suppositories to allay local irritation. In some patients, who suffer from aguish symptoms, the use of quinine, or infusion of cinchona, is generally of great benefit. In trying to pass instruments in such cases, whilst it is always advisable to get an instrument passed through the contraction, it is unwise to persevere too much ; there is not the necessity as in retention, and our manipulations may do harm. Still, as I have said, it is important, if possible, to pass an instrument, however small, fairly through the stricture into the bladder for this is always

attended with relief of irritation, whereas unsuccessful attempts generally increase the irritability of the urethra and bladder.

In such old tight strictures one cause of difficulty and embarrassment is the existence of numerous old false passages, some of them, perhaps, nearly parallel to the natural passage, and of considerable length, and as their walls are consolidated, the sensation in passing the instrument is very similar to that of passing through a stricture, whilst there is no bleeding, as when a new false passage is made in catheterism. In most instances, by gentle and careful use of the probe-pointed bougie or stricture-staff, we will succeed in getting it into and through the contraction ; but I have occasionally succeeded in some cases of very tight strictures, complicated with false passages, by a simple and ingenious method long practised on the Continent. It consists in passing a number of fine probe-pointed whalebone bougies. Say that there exist three false passages.—The surgeon takes one of these instruments and tries to pass it through the stricture, but feels that it has found its way into a false passage, and leaves it there ; he then tries another, and leaves it in like manner in another false route ; and so with the third. He now takes another of the bougies, and as all the three false passages are pre-occupied, this, if passed gently, almost infallibly passes into and through the stricture. The whalebone probes are so fine that they will pass through a contraction which will admit a bristle, and their delicacy prevents undue force being used. I have never tried this plan in retention cases, because the congested state of the parts seems to me to be unsuitable for it, and besides, we require to pass an instrument of sufficient size to evacuate the bladder. Dr. Gourlay, of New York, has ingeniously adapted this method as a means of conducting a metallic catheter grooved on its convexity down to the stricture, so as to enable him to divide it by perineal section in cases of very tight strictures ; but the fine probe-pointed grooved staff, passed fairly through the contraction, is a much surer guide for the knife.

The *Curative Treatment* of organic stricture is conducted by different methods and on different principles, but all have for

their ultimate object the more or less rapid and complete removal of the conditions causing the contraction or obstruction. It would be alike difficult and useless to try to enumerate all the plans proposed for the treatment of urethral stricture. I shall confine my remarks to the methods now practised. These may be classified under the heads of—Vital dilatation, Destruction of the contraction by caustics, Division of the stricture by lancette-catheters from within the canal or by Perineal section from without, and by forcible dilatation or rupture of the contraction, as by Holt's method. Some of these plans of treatment I can do little more than mention. The methods which, from extensive experience in stricture cases, I consider really safe and effective, are—Vital Dilatation, Holt's Method, and Perineal Section.

Vital dilatation is perhaps the method most generally applicable in ordinary cases of stricture, especially in private practice, and therefore I shall begin with it. By this method, I mean the introduction of an instrument through the contraction, and leaving it for a longer or shorter time for the purpose of promoting absorption of the new material which has caused diminution of the width of the canal; repeating this process every three or four days, and gradually increasing the size of the instrument until we can pass one which fully occupies the orifice of the urethra, which I have indicated as the natural gauge of the calibre of the rest of the canal. The principle upon which we proceed may be understood from what we find takes place in cases of retention in which we leave in a small catheter, say No. 1 or No. 2. After ten hours or less the urine is noticed to trickle along the sides of the instrument, as well as through it, and when, at the end of twenty-four or forty-eight hours, we remove the small catheter, which was at first tightly held, we find that a No. 4 can be passed with perfect ease, showing that, beyond the mere mechanical distension, vital causes have been acting on the organised material, and have led to partial absorption of it. Indeed, at one time, this plan of causing rapid vital dilatation was used as a general method, instruments being introduced in succession, and left

in until, at the end of a week, a full-sized catheter could be passed. The excitement caused by such a procedure, however, is hurtful and dangerous ; and, moreover, this treatment, even when not attended by constitutional disturbance, was found to be followed by rapid return of the contraction, and it is now, I think, abandoned. It was carrying a good principle to the extreme, without considering anything but the local action ; we may take advantage of it to gain ground until we can pass a No. 3 or 4 easily, but after that the dilatation ought to be carried out gradually.

To describe the proper treatment by dilatation succinctly, I will suppose that you have passed a No. 2 fairly through the stricture, and that it is tightly grasped. You leave it in the canal for five or ten minutes, and then withdraw it, and advise the patient to keep at rest as much as possible for a few hours. In many cases this is best secured by arranging to pass the smaller-sized instruments in the evening. If no great irritation follows, in three days you should again pass No. 2, leave it for a few seconds, and then pass No. 3, leaving it in for five minutes or so ; and so you proceed gradually, until complete dilatation is effected, always passing the size of bougie you used on the last occasion, and then the next larger size. Never yield to the temptation to gain ground by passing over one size, or by passing two larger sizes at a time. You are almost sure to excite undue irritation, and more likely to lose than gain ground. At the commencement of the treatment, when only the smaller sizes can be introduced, I prefer catheters, especially if there be any false passages, so as to make sure that the instrument is fairly in the bladder. When we reach the larger sizes, the metallic bougies answer better and produce less irritation.

In many patients affected with stricture the introduction of an instrument, however gently and easily accomplished, is almost invariably followed by a rigor more or less severe. From what I have observed in such cases, I have come, rightly or wrongly, to associate this with irritation produced by the passage of the instrument over the prostatic portion of the urethra and neck of the bladder, and practically I have found that in most instances I

can diminish or obviate this symptom by the following method :— When using small instruments, where I consider it essential to pass them into the bladder, so soon as the flow of urine satisfies me that this has been effected, I withdraw the catheter from the bladder and prostatic portion of the urethra, and leave it in the stricture ; and when passing larger-sized bougies I merely pass them fairly through the stricture, and no farther.

During the treatment by dilatation, the patient should avoid stimulants, and drink freely of diluents to allay the irritation of the bladder and urethra. When dilatation has been fully effected, he should be taught to pass an instrument, and advised to use it once a fortnight, to prevent any tendency to relapse ; and this should especially be insisted on in the case of patients going abroad, or to places where surgical aid cannot be obtained. At the same time, I regret to say such advice is seldom long attended to ; the patients, after a time, gradually forget their former sufferings, and neglect to use the instrument until some difficulty in passing water shows that the contraction has returned.

There is another method of treatment, which used to be called vital dilatation by Dupuytren, and which has more recently been termed cross-tunnelling, but which I think very dangerous. It consists in introducing an instrument down to the stricture, and tying it in, with the point resting against the obstruction. The principle of this plan is founded on the assumption that the force of the urine on the proximal, and the pressure of the catheter or bougie on the distal side of the stricture, will cause absorption to take place, and that ultimately the stricture will yield. The progress used to be measured from day to day by the stem of the catheter. I have repeatedly seen instruments passed in bit by bit in this way, until they should have passed into the bladder, but on examination it was found that they had only dilated false passages. In treatment by dilatation, therefore, we should always try to get the instrument into the bladder, and carry out the dilatation as I have advised, for that is the only safe plan of effecting our object.

LECTURE CXXIV.

Treatment of Urethral Stricture, *continued*—Use of Caustics : their Dangers—Holt's Method of Immediate Dilatation—Precautions after Treatment—Section of the Stricture from within by Lancetted Catheters—Perineal Section—Old Operation in Impermeable Contractions—Syme's Method : description of the Operation—Special points to be attended to in Operating, and in the after-Treatment.

THE employment of caustics in the treatment of stricture was had recourse to in old times, in the first instance, in consequence of the erroneous pathological opinion, that the obstruction was always due to the projection of caruncles or warts from the lining membrane of the urethra, the destruction of these growths being the object aimed at by this plan of treatment. In more recent times, the application of nitrate of silver in the treatment of stricture was revived by John Hunter, and subsequently extensively practised by Sir Everard Home and others. It was first used, not to destroy the contraction, but with a view of allaying the morbid irritability often present in cases of stricture. Some forms of stricture are excessively irritable, so that the passage of an instrument invariably gives rise to constitutional disturbance, as well as intense pain at the time. Hunter used the nitrate of silver in such cases at first, with the view of exhausting the morbid irritability of the part, and altering the action of the morbid surface, as we do in the case of irritable ulcer. To that extent the treatment was justifiable and useful.

It happened, however, that, in some cases in which the caustic had acted more energetically than usual, the contraction was destroyed, and that large bougies could be introduced into the bladder more rapidly than by the ordinary treatment. This led to the caustic or armed bougies being used, so as to effect destruction of the contraction, as a method of treatment ; and this,

as I have said, was at one time extensively practised, and is still, I believe, practised by some surgeons.

I consider that destruction of the contraction by caustic is exceedingly dangerous. I have treated and seen many cases of stricture in which caustic had been previously used, and have no hesitation in saying that they were the most troublesome and worst cases I have had to deal with. In most of them, the complications of abscesses in the prostate, or fistula in perineo, were present, with irritable bladder and tendency to renal disease. In all, the strictures had become contracted and hardened by the application of the caustic, and had the constant tendency to contract after dilatation, so that, before the use of perineal section, it was almost impossible to keep the canal patent by the use of instruments.

Whately and Wade's method, by the use of potassa fusa instead of nitrate of silver, which was also attempted to be revived some fifteen years ago, is, if possible, worse. I have, in several cases, seen false passages resulting from its use. In one instance a patient applied to me, saying he had a bad stricture. I used a No. 10 bougie, as I generally do when examining a patient for the first time. The instrument passed, with the greatest ease, apparently, into the bladder, so that I could fully depress the handle, and feel its point free in a cavity. As it is not a very unusual thing to find, on examination of supposed stricture cases, that there is no stricture, I merely observed that, from the way in which the instrument passed, I did not think there was any great obstruction; on which the patient said, "The bougie has gone by the false passage, and if you examine you will find its point in the gut;" and so it was. The caustic had established a false passage into the rectum large enough to admit a No. 13 bougie, whilst a No. 3 catheter could only be passed with difficulty by the true passage through the contraction. I succeeded in curing the stricture by gradual dilatation, and the false passage contracted, but never closed completely, so that great care was required in passing instruments. Unfortunate results like these show the uncertainty and danger of using such agents as caustics, which may

make a false passage for themselves, and which, even if they do pass into or destroy the contraction, only aggravate its condition ultimately, and predispose to abscesses in the neighbouring parts and disease of other organs.

HOLT'S METHOD of IMMEDIATE DILATATION, or rupture of the contraction, is the method of treatment which I consider most suitable for the treatment of tight firm strictures. If the kidneys and prostate gland are not affected by disease, this plan of treatment is, I believe, nearly, if not quite, as safe as that of gradual dilatation, and I should always advise its employment in cases where the contraction returns quickly after dilatation; for although I do not believe that any method of treatment will absolutely preclude the return of the contraction, or that it is ever safe to neglect the occasional use of a bougie to maintain the patency of the canal, still the tendency to relapse seems less after Holt's method than after simple dilatation.

I was at first much prejudiced against this plan, owing to what I had seen of the effects produced by the forcible dilatation with the conical sound. In cases where that instrument had been used, I had noticed that an irritable and resilient state of the contraction was the almost invariable result. From some opportunities I had of examining strictures dilated by this method, on the dead body, I found the mucous membrane at and on either side of the stricture fissured, and I considered this condition so similar to that of fissure of the rectum, that the intense irritability seemed to me referable to this fissured condition of the mucous membrane. Hence the immediate dilatation, by Mr. Holt's method, seemed to me as likely to lead to the same disagreeable results; but, after trying it in some cases, and having had an opportunity of examining a stricture which had been treated by his method, I found there was a difference between its action and that of the conical bougie. I saw that by his plan the stricture was fairly ruptured, not only through the mucous membrane, but through the condensed submucous tissue forming the contraction.

Now we know all that is required to cure the excessive irritability of fissure of the anus, is division of the fissure fairly through its hard base; and whilst we usually effect that with the knife, still it can be effected by the coarser method of forcible rupture with the fingers; so that Holt's method, by fairly rupturing the hardened basement texture of the contraction, prevents, or even cures, the irritable condition of the stricture, and thus acts very differently from the partial fissuring of the mucous membrane caused by the conical bougie.

For the last nine or ten years I have practised Holt's method, and with great success, so that I feel no hesitation in recommending it as at once efficacious and safe—that is, as free from danger as any operation on diseased urinary organs can be. I need not repeat, that all the usual precautions must be taken that the patient be in a proper state for interference of any kind; but I very seldom now have recourse to the large doses of quinine recommended by Mr. Holt as prophylactic. I believe nothing more is necessary than the ordinary attention to the general health and state of the urinary organs, and characters of the urine. This preliminary treatment can be carried out whilst we continue ordinary dilatation up to the gauge of No. 3 catheter.

The operative procedure is very simple. The dilator is passed closed, till its point enters the bladder, and this is made sure of by withdrawing the stilette from the small tube within the dilator, when some drops of urine will flow by it if it has entered the bladder. But we must recollect, that, from the form of the instrument, if it be passed far in, its point rests against the walls of the bladder, so that, if the urine does not flow, we should withdraw the point a little, and then the urine will come if the instrument is fairly in the bladder; and we must make quite sure of that before we proceed to the next step. The rupture of the stricture is effected by loosening the screw which fixes the blades of the instrument, near the handle, so as to allow them to open. We then pass the dilator upon the tubular conductor, between the blades, and push steadily and forcibly till

we feel the contraction yield. Lastly, the instrument is withdrawn, and a No. 10 or No. 11 catheter passed into the bladder, and the urine drawn off. The patient is then desired not to make water himself, but to have his water drawn off with the catheter every six hours, for the first twenty-four.

I have always adopted this precaution, although some consider it unnecessary; but I regard it as a safeguard against infiltration; and if we fairly rupture the contraction, as we ought to do, some infiltration might occur; indeed, I have seen it take place in one case, that of a stricture about three inches from the orifice, which I split, and where the patient neglected the direction I had given. I am also aware that occasionally patients are told that there is no necessity for even remaining quiet for twenty-four hours, but that they may go about as usual; but, in really serious cases of stricture, that is not safe advice nor judicious practice. Unless the natural orifice of the urethra is very small, I always at once use the largest of the dilators, so as to ensure complete rupture of the contracted portion of the canal and the condensed surrounding textures. At the end of eight or ten days I pass a No. 10 catheter; repeat this at gradually increasing intervals, and then instruct the patient to pass one for himself occasionally, so as to guard against relapse.

The treatment of old unyielding strictures, by dividing the contracted portion of the urethra with cutting instruments, has often been recommended. The methods generally adopted were either the old operation, termed "*la boutonnière*," which used to be practised at first only in cases of impermeable strictures arising from partial destruction of the canal, with a view of restoring its continuity, but gradually came to be used in cases called impermeable, where the surgeon could not pass an instrument into the bladder. The operation consisted in passing a full-sized catheter down to the obstruction, cutting down upon it in the mesial line of the perineum, and dissecting backwards to try to find the urethra beyond the contraction, and then, after cutting through the dense intervening structure

forming the contraction, passing the catheter onwards into the bladder, and retaining it there for forty-eight hours at first, and introducing it occasionally to re-establish the course of the urethra. This, however, was a most uncertain and difficult operation, as in the method adopted there was no guide to the posterior part of the canal amongst the altered textures, and when success was attained it was by chance. When I come to speak of puncture of the bladder, I shall point out how, by using a modification of the foregoing operation, the membranous part of the canal can, with certainty, be reached, so as at once to relieve the retention and re-establish the canal. But, as a method of treating stricture, the boutonnière is certainly not one which I should recommend, and I would specially guard you against confounding it with Mr. Syme's method of perineal section, which I shall immediately describe.

Division of the stricture from within has long been practised, especially on the Continent. I can hardly conceive any method more uncertain and dangerous. If the form of instrument used is such as not to pass within the contraction, but is only passed down to the stricture, and the lancet then projected with the intention of dividing the obstruction, it is quite as likely to cut the less resisting textures and form a false passage. If, on the other hand, the instrument is to pass within the contraction, before the lancet is projected, then a stricture which would admit an instrument of such a size would not require such a hazardous operation. In any form of division of the stricture from within with cutting instruments, the risks of bleeding and infiltration of the spongy texture of the urethra must be very great, and for my own part I consider it a method which should never be adopted.

PERINEAL SECTION for division of urethral stricture, as proposed by the late Professor Syme in 1844, and performed on the principles laid down by him, differs essentially from any of the foregoing methods for section of the contraction. It is an operation admirably adapted for the treatment of certain forms

of complicated stricture, attended with no great difficulty in its performance, not dangerous in itself, and attended with probably as little risk as any cutting operation can be in cases of diseased urinary organs. Since I began to use Holt's method, I have not performed perineal section so generally as I formerly did, but for nearly twelve years, whilst I used dilatation in ordinary cases of stricture in private practice and in hospital out-patients, I performed perineal section almost invariably in all resilient, irritable, or old indurated strictures; and in the Edinburgh Royal Infirmary these were of frequent occurrence, and the results were most satisfactory. In the very few fatal cases which I have met with, the cause of death was almost invariably phlebotic pyæmia. I have never met with hæmorrhage or urinary infiltration, the bugbears which used to be urged against this method; and, therefore, though I now use Holt's plan in many cases where I should formerly have performed perineal section, yet in cases of cartilaginous irritable resilient stricture, with induration of the perineal textures, or perineal fistula, I prefer perineal section by Mr. Syme's method to any other plan of treatment, and still frequently perform it. I have said that the operation is not difficult, and that its performance is effected with certainty if the principles laid down by Mr. Syme be attended to, together with some minute points in the manipulations, the neglect of which makes all the difference between a perfect and an imperfect operation.

I shall first briefly describe the mode of performing the operation, and then allude to the points which I consider as deserving special attention. The instruments required are a grooved stricture-staff, a small sharp-pointed bistoury, and a No. 10 silver or gum catheter. The perineum having been shaved, and the narrow part of the staff passed through the stricture fairly into the bladder, the patient is placed in the same position as for lithotomy, and the hips brought close to the edge of the table. The operator feels for the termination of the thick shoulder of the staff in the perineum, begins his incision over it exactly in the line of the raphé, and cuts backwards for about

two inches. He next feels for the groove in the narrow part of the staff with the point of his right forefinger, and having felt the groove distinctly, he takes the handle of the instrument in his left hand, and guarding the point of the bistoury on his right forefinger, inserts it with its edge directed forwards into the groove, and carries it forwards through the stricture into the grooved part of the thick shoulder of the staff so as to divide the stricture thoroughly, and depresses the handle of the staff gently till he feels its thick portion pass fairly into the membranous portion of the urethra. Lastly, he withdraws the staff and introduces the full-sized catheter into the bladder, and retains it by tying it in position.

Such is a general description of the operation of perineal section. The points deserving attention are, first, the instruments. The staff consists of an anterior thick portion, which should be always about the gauge of a No. 11 catheter, and should terminate in an abrupt manner to mark the anterior boundary of the contraction. The narrow portion of the staff varies in gauge from No. 3 down to the small probe-pointed instrument for very tight strictures. The groove should be carried well up from the narrow into the thick portion of the staff, so as to allow the knife to cut freely forward. The set consists of four of these steel instruments, and a small probe-pointed grooved silver director, used in cases of tight strictures in the anterior part of the urethra. The knife should be an ordinary small-sized bistoury in a fixed handle, very sharp at the point, with the back part of the point slightly bevelled off, by touching it on the stone in setting the instrument. The gum-elastic catheter is most suitable for leaving in the bladder; but in case of any difficulty in introducing the catheter owing to the point passing out of the wound in the urethra, the silver catheter should be at hand, as it can be guided with greater certainty. Secondly, as to the procedure, the staff should always be introduced fairly into the bladder, and entrusted to an assistant before the patient is placed in position for the operation. Immediately before commencing his incision, the surgeon should, by examining from the rectum, satisfy himself as to the staff being

fairly in the bladder. In commencing the incision, the thick shoulder of the staff forms an excellent guide as marking the anterior limit of the contraction, and therefore the incision should begin over it and be carried backwards to the requisite extent. The incision must be exactly in the middle line or raphé of the perineum, and should be carried deeply at once, especially as it passes backwards from the thick part of the staff; by so doing we avoid the risk of lateral dissection in the deep part of the wound, and the danger of going to one side of the small grooved part of the staff, and come directly down upon it. In cases of indurated perineum, where we might expect great difficulty, we often find the narrow grooved portion of the staff very easily, as the textures do not yield laterally or separate. Moreover, by a decided deep incision in the middle line we incur less risk of hæmorrhage. On completing this incision, the operator should pass his right forefinger into the posterior part of the wound, and, with the pulp of the finger directed forwards, feel for the groove in the narrow part of the staff behind or on the vesical aspect of the stricture. If the incision has been deep and well placed, he will generally feel the staff easily; if not, he must touch the textures with the knife directed in the middle line, until he feels the groove almost bare. It is at this stage that an error is apt to occur, unless you attend to a point which you might possibly think of but little consequence in the description of the operation as given by Mr. Syme, but the neglect of which, I am satisfied from experience, was often the cause of difficulties and imperfection in our earlier operations for perineal section. Mr. Syme directs that, on the groove being felt, the knife, guarded on the forefinger of the operator's right hand, should be inserted into the groove; in other words, whilst the point of the forefinger has felt and is fixed against the groove, the knife, which has been lying upon the finger, is projected forwards so that it must enter the groove; it cannot pass to either side, and hence is directed at once into the centre of the groove, however narrow that may be, and easily carried through the contraction by pressing it forwards by the finger placed behind it. If, on the contrary, we

do what was very generally done in the earlier operations for perineal section—viz., use the finger of the left hand to feel for the groove in the narrow part of the staff, as is done in lithotomy, and then pass the knife over the nail of the left forefinger which is fixed in the groove as a guide—the knife is directed to one side, misses the small groove, and is carried along the side of the staff, thus leading to an imperfect incision, or to uncertainty as to complete division of the stricture. I repeat that this apparently trifling manœuvre is of the greatest importance as to the ease and certainty with which the stricture will be divided. The edge of the knife should always be carried well forward into the groove in the thick portion of the staff. There is another precaution which I take at this stage, and which I consider should never be neglected. When the stricture is divided, we are told to withdraw the staff and proceed to introduce the catheter. But we must first make quite sure that the whole contraction is divided. The limit of the stricture in front is well marked by the thick shoulder of the staff arrested there, but the posterior limit is not so surely marked, we judge of that chiefly by feeling the groove less thickly covered. Even as regards the anterior part, a few fibres may escape before the pressure of the knife, but we can give perfect certainty to the complete section of the stricture by using a very simple precaution. Instead of withdrawing the staff, I pass my left forefinger into the wound, and with my right hand depress the handle of the staff so as to carry it towards the bladder. If the contraction be fully divided, the thick part of the staff passes on easily beyond the cut in the urethra into the membranous part of the urethra, and its position is felt by the finger in the wound. If, on the contrary, there be any catch or hindrance, I never attempt to force the staff onwards; but, again using my left hand to steady the staff, I re-introduce the knife on my right forefinger and divide any resisting fibres, whether at the anterior or posterior part of the urethral section, until the staff glides easily onwards. No force to overcome a difficulty should be used. It may be that a small portion of the anterior boundary of the contraction has escaped

complete division ; very little propelling force would overcome this, as the remains of the white fibrous texture would readily yield for the time, and permit the instrument to be carried on towards the bladder ; but the operation would be incomplete, and contraction would soon return. Moreover, by this same precaution, the introduction of the catheter is rendered more easy and certain.

As regards the introduction of the catheter, we should be careful to keep the point of the instrument bearing gently on the upper or pubic wall of the urethra, to avoid the risk of its passing out through the section, and getting entangled in the tissues of the wound. Should any hitch occur, do not press on, but withdraw the instrument, and introduce it again, keeping the finger of the left hand in the wound to guide its point if necessary. I have already said I prefer the gum-elastic catheter to be retained in the bladder. It is best secured in position by means of a silk thread tied round the ivory mouthpiece of the instrument, the ends of which are carried back, one on either side of the glans penis, and secured by a circular strip of adhesive plaster. If a silver catheter be used, it should have a very short point. We secure it in the following manner, which is that used for securing the silver catheter under any circumstances :—A broad bandage is tied round the abdomen above the crest of the ilium. To this we fasten two perineal loops on either side. These loops are simply narrow strips of bandage, brought obliquely from under the perineum on each side, and tied to the abdominal bandage. Through each ring of the catheter a narrow strip of oiled silk, or a piece of thin string waxed or oiled is passed, and the ends secured to the perineal loops on each side.

Care should be taken not to tie the catheter too far in, nor to allow the water to flow off through it continually, because the small thickened bladder will contract on the point of the instrument, and ulceration of the mucous coat may ensue. This happened in one of my cases, at a time when, from dread of the risk of infiltration, which was then so much spoken of, the practice was to allow the urine to flow off continuously. Since then I

have almost invariably used a gum catheter, and in all cases I leave a plug in the instrument, which can be withdrawn when necessary. Bad results might occur from tying in a full-sized instrument for any cause, if the bladder is permitted to be constantly empty, owing to the continuous draining away of the urine.

The after-treatment of perineal section is very similar to that of lithotomy cases—anodynes at first, and the free use of diluent drinks, to allay irritability of the bladder. The catheter should be withdrawn at the end of forty-eight hours, or earlier, if it cause much irritation. At the end of ten days a No. 8 or No. 9 catheter should be passed, and then at intervals of eight days, as the wound heals. For the first fortnight the patient should be kept in bed, but after that he may be allowed to sit up, or walk about, unless the wound be irritable.

In concluding this important subject, I would briefly state, in a dogmatic form, the methods of treatment I should recommend in cases of stricture.

1st. In the simpler cases of non-irritable stricture, and where the patient cannot conveniently be confined to the house, even for a few days, vital dilatation methodically carried out on the principles I have laid down.

2d. In more severe, irritable, indurated, and resilient strictures, I prefer Holt's method of splitting the stricture, as it involves very little risk, is uncomplicated with wound, and is therefore attended with less necessity for confinement in the after-treatment.

3d. In tight cartilaginous and irritable strictures, with induration in the perineum or abscess, or complicated by fistulous openings, I should recommend perineal section on Mr. Syme's principle.

LECTURE CXXV.

Puncture of the Bladder for Retention of Urine in cases of Stricture—Puncture by the Rectum : by Incision from the Perineum—Extravasation of Urine—Symptoms of rapid Extravasation from yielding of the Urethra behind the Stricture—Treatment—Extravasation resulting from neglected Urinary Abscess—Fistula in Perineo—Different forms of Perineal Fistulæ, and their Treatment—Retention of Urine and Catheterism in the Female.

OCCASIONALLY, but very rarely, cases of retention occur in which the surgeon requires to puncture the bladder. There are two methods of doing this. The bladder may be punctured from above the pubes, as already described when speaking of diseased prostate, or by the rectum in cases where the prostate is of its natural size. The latter is a very simple mode ; rather too simple in fact, because some surgeons are much inclined to resort to it, rather than persevere in attempts to pass the catheter. In retention of urine from stricture, unless there be absolute destruction of the canal, the surgeon ought always to be able to pass a catheter. If he perseveres skilfully, he will hardly ever fail in doing so, though it requires, as I have already shown, some determination and experience. Sometimes it may happen that a person who has had few opportunities and little experience in treating stricture will be called in to a difficult case ; and then, if he cannot obtain further aid, puncture of the bladder by the rectum is certainly preferable to delay, or dangerous efforts with the catheter. When the bladder is distended, and the prostate healthy, the bladder bulges towards the rectum and between the vasa deferentia and vesiculæ seminales on either side, there is a point below the reflection of the peritoneum from the rectum to the bladder, where that viscus is in close contact with the bowel.

In puncturing the bladder from the rectum, the surgeon

passes two fingers into the rectum, till he feels the base of the prostate. He then takes a curved trocar and canula (Pouteau's)—the trocar being drawn back within the canula—presses the point of the canula against the bulging portion of the bladder, as represented in Plate lvii. Fig. 2, and then pushes the trocar onwards until perforation is effected, and the urine evacuated. The canula is then tied in the rectum, projecting into the bladder, and left there for forty-eight hours, until the surgeon is able to introduce a catheter and dilate the urethra, which can often be more readily done after the bladder is relieved, and the congestion and irritability of the canal allayed.

I have only twice punctured the bladder from the rectum. Once, nearly thirty years ago, in a man who had been previously subjected to rather rough catheterism, and who would not submit to allow me to try the catheter. There could have been no real necessity for puncture, as I passed a No. 6 catheter easily two days afterwards. The second case occurred in my hospital practice, and was rather puncture of a vesical cyst than puncture of the bladder in the usual way. A full-sized catheter was introduced into the bladder, and relieved it, but not the distended cyst, and therefore puncture of the cyst was absolutely necessary. (See Clinical Cases.)

When, from any cause, it is necessary to resort to an operation to relieve the distended bladder, there is another method which is, I think, much better than puncture by the rectum.

Where there is absolute obstruction of the urethral canal from injury or disease, we have a fixed and sure guide to opening into the membranous part of the urethra. By passing the forefinger of the left hand into the rectum, we can feel the apex of the prostate gland distinctly, and in front of the prostate the dilated membranous portion of the urethra can be reached and opened with safety. In operating, the surgeon, having his finger in the rectum in contact with the prostate, takes an ordinary straight bistoury and plunges it into the mesial line of the perineum, in front of the anus, with the back of the knife towards the coats of the rectum, and, keeping its point directed obliquely upwards

PlateLVII. PUNCTURE OF BLADDER & IMPERFORATE ANUS.

Fig. 1

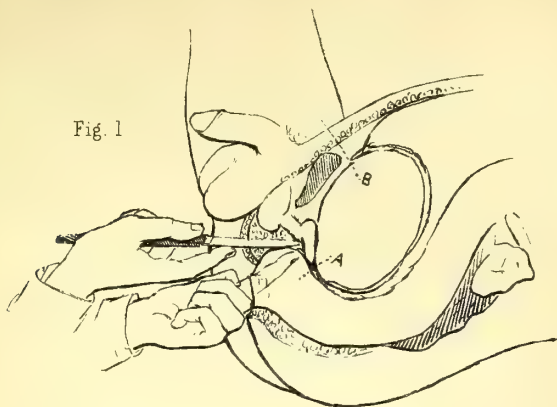


Fig. 2

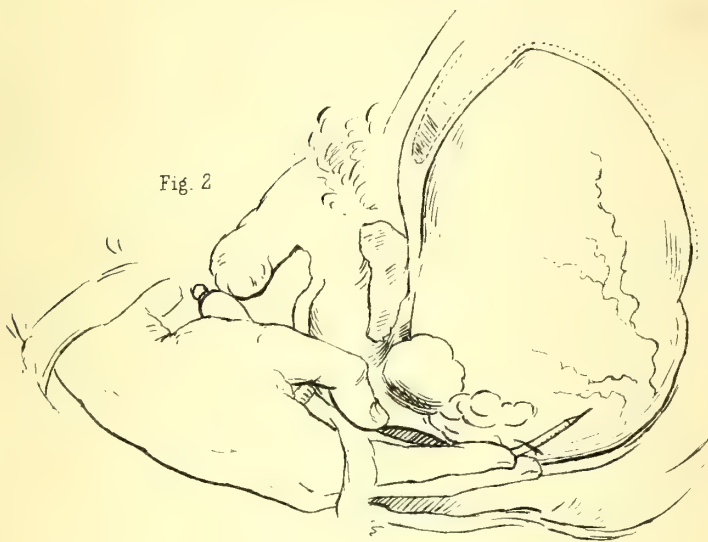
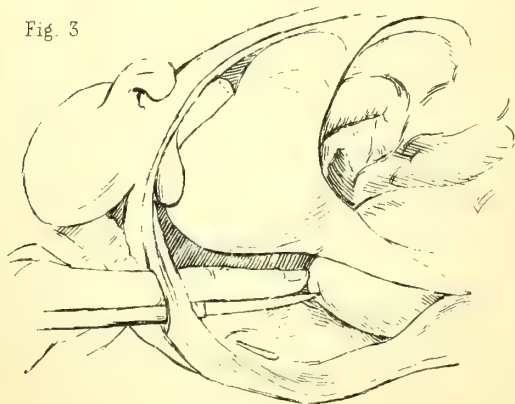
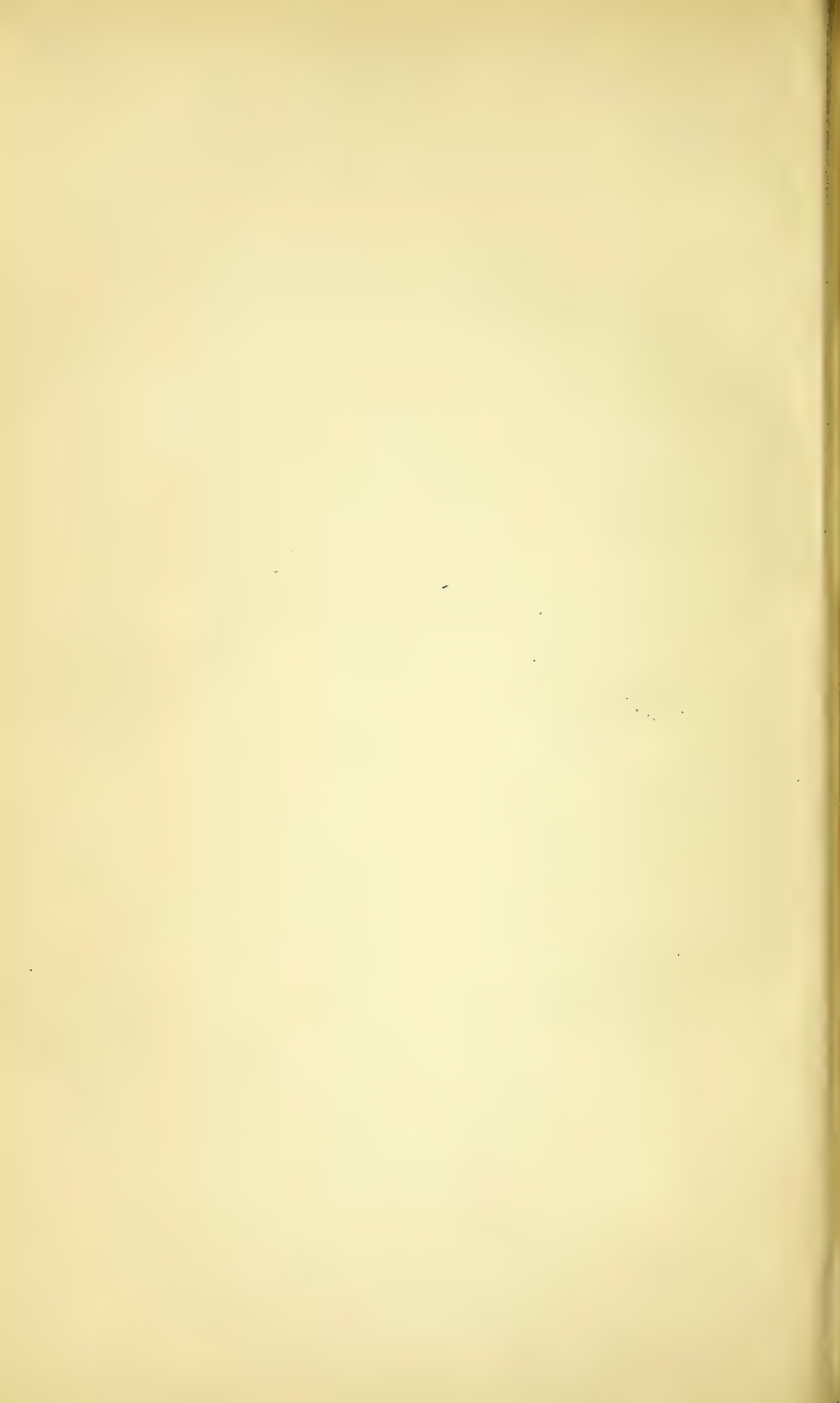


Fig. 3





he cuts freely, as if he were going to cut into the apex of the prostate. That gland forms a fixed point in front of which he cuts into the membranous part of the urethra (Plate lvii. Fig. 1), and the urine then escapes. Afterwards, he either leaves in a lithotomy-tube, or introduces a catheter down to the obstruction in the perineum, cuts on its point, and passes it on to the bladder, so as to re-establish the urethra. This may seem a difficult operation, but it is really not so. It is, I think, a much safer and better operation than puncturing the bladder from the rectum, as it not only relieves the retention, but enables us to restore the natural passage at once. It can, however, only be required in cases where the continuity of the canal of the urethra has been destroyed by injury, and where, therefore, a catheter cannot be passed, or when the scrotum and penis are involved in a cancerous swelling. I have performed the operation several times under both of these conditions, and met with no difficulty.

EXTRAVASATION OF URINE may occur from various causes, some of which, such as injuries of the urethra and bladder, have been already spoken of. When the extravasation takes place in certain positions, as at the neck of the bladder within the pelvis, or when it escapes into the abdominal cavity, we have seen that the condition is one which does not admit of much being done for its relief. It is different, however, with respect to extravasation or infiltration of urine in the perineum. In that case we can do much to save life, and prevent, or at least diminish, the destruction of tissues, if only our interference be prompt and decided, and I therefore desire to draw your attention very specially to this subject. It is not a condition in which you can wait to have a consultation or obtain aid. To be of service you must act at once, and understand how to act, and the principles on which you proceed.

I have said that extravasation may arise from injuries of the urethra and other causes; but in this position it most usually occurs in consequence of obstruction in the canal, and in connection with urethral stricture.

There are two forms in which it may arise. One almost instantaneous in its occurrence, rapid in its destructive effects, and attended with very marked local and constitutional symptoms. The other, preceded by the formation of deep abscess in the perineum, and only supervening as a consequence of that having been neglected, and hence its progress and symptoms are different from those of the former, and perhaps not attended with so much, certainly not with such immediate, danger.

I shall first describe the condition in which the urine escapes, and is rapidly extravasated into the tissues. This usually occurs in cases of tight indurated strictures. In such instances there are always pathological changes, tending to ulceration of the urethra behind the stricture, resulting from long-continued irritation, and the pressure of the urine from behind over-distending the canal immediately on the vesical aspect of the contraction ; and in cases of retention under such conditions, unsuccessful attempts to introduce catheters may also tear and still further weaken the walls of the urethra. Under such circumstances the patient, straining with great force to empty the over-distended bladder, feels something give way, and experiencing the relief of the bladder evacuating its contents, thinks he is making water, but seeing none coming by the natural passage, he becomes alarmed, especially when he finds a sudden swelling between his thighs, and distension of the scrotum and penis. The urethra has yielded in the perineum behind the stricture. The momentary relief is soon followed by an intense burning sensation in the perineum, and medical aid is procured.

If the surgeon sees the patient immediately after the occurrence of the extravasation, he finds the scrotum and coverings of the penis swollen and tense, and the anterior part of the perineum occupied by a tense prominent swelling, at first sharply defined. This perineal swelling is continuous in front with that of the scrotum ; posteriorly, in the middle of the perineum, it passes no farther back than about three-fourths of an inch from the anus ; but laterally

and posteriorly it approaches the point of junction of the ramus with the tuber ischii ; laterally it is defined by the line of the rami of the ischium and pubes on each side. After a time the definition may be less marked, owing to acute œdema of the subcutaneous tissue supervening. If the extravasation is allowed to proceed, the swelling passes up along the course of the spermatic cord, to the lower part of the abdomen.

It is of importance to notice the form and course of the swelling, as seen at the early stage, as that explains the site of the extravasated fluid, and indicates the measures necessary in the treatment. An examination of such cases shows that the urethra has given way behind the stricture, very generally just behind the bulb, and that the urine is extravasated below the triangular ligament, between it and the true superficial fascia of the perineum. The superficial fascia of the perineum, after passing over the muscles covering the bulb and crus penis, and the transverse muscles of the perineum, is reflected or passes deeply behind the last-mentioned muscles, and becomes intimately united to the posterior margin of the triangular ligament. Laterally, as it ascends, it covers in the crus penis on each side, and immediately external to the crus it becomes firmly connected to the fascia covering the muscles of the thigh, which arise from the rami of the pubes and ischium ; anteriorly, at the scrotum, it is continued as a part of the scrotal coverings, and thence along the chord to the lower part of the abdomen, where it can be traced as continuous with the fascia of Scarpa or deep layer of the superficial abdominal fascia. The anatomical arrangement of this fascia determines the position of the swelling caused by the effused fluid, and the course which that fluid takes.

It will be at once seen that in the perineum the connections of the superficial fascia and its relation to the triangular ligament form a sac closed posteriorly and laterally, so that fluid effused between the triangular ligament and the superficial fascia cannot gravitate or pass back towards the anal or posterior region of the perineum, or laterally towards the thighs, but must necessarily pass forwards and upwards to the mouth of the pouch, where

the superficial perineal fascia becomes continuous with the coverings of the scrotum, in which direction it finds a ready vent into the loose cellular tissue under the coverings of the scrotum and penis. In cases where the urethra gives way a little in front of the bulb, besides the swelling described, a portion of the urine sometimes infiltrates the erectile spongy texture, causing gangrene, which is indicated by the glans penis becoming black, or presenting black spots on its surface and in its substance. The condition thus indicated is one of great danger, and the prognosis most unfavourable.

In the course of a very short time the swollen and distended parts become discoloured, at first of a dusky red, and then mottled with black patches, and the character of the swelling gradually alters. It becomes boggy and emphysematous, rather than tense, and the same condition extends over the abdomen, ascending gradually higher and higher unless interfered with.

These local conditions speedily give rise to marked constitutional symptoms. The patient becomes feverish and excited, with a quick, sharp, or jerking pulse. The fever speedily assumes the irritative typhoid character. The tongue becomes dry, the skin is covered with profuse perspiration, and exhales a urinous odour, there are low muttering delirium, fumbling with the hands, cold clammy sweats, and finally, unless decided measures be resorted to at once, coma and collapse close the scene.

When called to a patient suffering from extravasation of urine, the character of the swelling, in conjunction with the circumstances accompanying, should leave no doubt as to the nature of the case; and the treatment, to be effective, must be immediate and decided. No delay is warrantable, even though the constitutional symptoms may not have arisen; our object, indeed, should be to prevent or diminish these. There is no use in wasting time in attempts to pass the catheter; for even supposing you managed to get it into the bladder, it would do no good, for the contents of the bladder have been already extravasated amongst the tissues, and you must relieve that condition by free incisions.

To evacuate the extravasated fluid and sloughs of cellular tissue destroyed by the action of the urine, you must make a free and deep incision in the middle line of the perineum, from behind the lowest part of the perineal swelling forwards to the root of the scrotum, and lateral incisions also in many cases. Incisions must also be made into the scrotum, coverings of the penis, and into the boggy swelling over the chord and abdomen. In a word, wherever the swelling indicates that the urine has infiltrated the tissues, there we must incise freely to permit it and the sloughs of gangrenous tissue to escape. The incision must be deep and long, so as to pass through the fascia, and any sloughing fascia or tissue should be pulled out or clipped away, as it is a source of irritation, and acts also as a mechanical barrier to the escape of the discharge.

When acute œdema has supervened, it is especially necessary to be on your guard against being misled by the apparent depth of your incisions, or the escape of serous fluid. Through the long central incisions in the perineum you can introduce your finger and feel the bulb and other deep structures, if you have made the cut of sufficient depth. Punctures or small incisions, even if deep, are of no use. Part of the urine may escape in a fluid state, but the greater part is infiltrated into the cellular tissue, and incorporated with it, and therefore free deep incisions are absolutely necessary for relieving this state of the parts. When the sloughs and fluids escape, and the swelling subsides, you will find what, in the tense state of parts, appeared formidable-looking incisions, become very moderate in their dimensions ; besides the absolute necessity for free apertures of exit, by pursuing this course we really save tissues which would otherwise infallibly slough and be lost.

It is very seldom that any dangerous amount of bleeding follows the incision of the parts, but if any superficial vessels bleed smartly, it is necessary to tie them and cut off the ends of the ligatures. The subsequent local treatment consists in applying poultices with charcoal for some time, till the sloughs are fairly thrown off ; afterwards, chlorinated-soda, and other lotions

are used, according to the appearance of the granulating surface. When the swelling is partially diminished by the incisions, we can introduce the grooved stricture-staff through the contracted urethra into the bladder, and use the central incision to reach the groove and divide the stricture, and then pass and retain a full-sized gum catheter in the bladder.

The constitutional symptoms are most likely to be relieved, if not prevented, by the active local treatment. But if they have arisen before the patient has been seen by the medical attendant, then stimulants to keep up the strength, anodynes to allay the general irritative fever, and subsequently generous diet, form the chief indications.

The other form of urinary extravasation which supervenes on neglected abscess in the perineum arises in a different manner from that which I have just described; and, accordingly, its symptoms are different and its progress less rapid, in consequence of the pathological changes which have preceded the extravasation limiting it for a time. Owing to the presence of stricture or some other source of irritation in or near the urethra, deep-seated inflammation is set up in the perineum, and as a result an abscess or collection of pus forms either under the superficial fascia or between the layers of the triangular ligament. This is attended by deep-seated, brawny hardness in the perineum, accompanied by great pain and constitutional disturbance, acute œdema of the scrotum, and, in most instances, painful and difficult micturition and pain and fulness about the anus. If these conditions be neglected, or if the surgeon waits for distinct fluctuation, the purulent matter, prevented from making its way towards the cutaneous surface, points and opens into the mucous canal of the urethra. In consequence of this ulceration, whilst part of the pus escapes by the urethra, urine passes into the cavity of the abscess, and excites increased action of an unhealthy character, constituting urinary abscess, and attended with the peculiar constitutional symptoms of urinary fever.

For a time the effused urine and purulent matter are confined by the barrier resulting from the plastic exudation which has

consolidated the tissues and formed the cyst of the abscess, and hence the fluid is not largely extravasated as in the ordinary form of infiltration of urine. Unless, however, free vent be given to the collection, the barrier soon yields before the pressure and destructive action of the acrid fluid, and then the fluid contents gradually infiltrate the surrounding parts, and lead to sloughing and unhealthy suppuration, undermining and destroying the deep as well as the superficial structures, and ultimately, though more slowly, the fatal results follow as in the former case, or the patient may die with the symptoms of a combination of pyæmia and uræmia. The pathological condition indicates the proper treatment, namely, early incision in all cases of suspected suppuration in the perineum, without waiting for fluctuation. When the symptoms of deep inflammation in the perineum have been followed by escape of pus by the urethra, without much diminution of the perineal swelling, and with perhaps increased local and constitutional irritation, no time should be lost in making a deep incision into the perineum to afford vent to the confined fluids, and so prevent mischief. Should the urine have made its way through the consolidated tissue forming the boundary cyst of the abscess, and become infiltrated, we must make incisions over its course, and apply poultices and fomentations, as in the usual form of extravasation of urine, to allay irritation and favour the escape of sloughs of dead tissue, whilst at the same time we support the patient's strength by stimulants and nutrient diet.

When speaking of the various pathological conditions arising in consequence of urethral stricture and complicating the treatment, I mentioned FISTULA IN PERINEO, and stated how it originated in abscess, and was kept up by the urine passing through the fistulous track so long as the contraction remained in front. When this condition has continued for some time, the sinuses and the main fistulous canal connected with the opening in the urethra behind the stricture become much consolidated, and lined with a structure resembling mucous membrane. In many

cases the whole perineum and posterior part of the scrotum present fistulous openings converging at the main track, and all the surrounding textures are thickened and consolidated owing to plastic exudation. In such cases, the first and most important indication for treatment is to restore the natural passage by curing the stricture. When that is done, nature in many instances accomplishes the rest of the cure, the urine flows by the natural canal, and the sinuses gradually contract and heal. In some cases, however, where great induration and many tortuous sinuses have existed for a long time, we may require to lay them open to some extent, and use a stimulant application, or the actual or potential cautery, to destroy the lining membranes and callous tracks of the fistulæ. This is best effected by means of the heated wire, or a probe coated with nitrate of silver, or by injecting a solution of nitrate of silver along the track, and when there is much consolidation and brawny hardness of the perineum the application of a blister is of great service in promoting absorption of the plastic exudation, and stimulating the parts to a healthy action.

We must, however, remember that fistula in perineo may depend on other causes than stricture, or be kept up by a state of parts which renders it much less amenable to treatment, or even incurable. In cases where abscess forms from any cause in Cowper's gland, even although it is opened early there is often a tendency to the formation of a troublesome urinary fistula. The short duct of the gland opening into the sinus of the bulb is involved in the diseased condition, and hence the ulceration opens into the urethra, and urine dribbles through the abscess and, though there be no obstruction in front, keeps the external aperture from contracting, and this condition is very troublesome and tedious of cure. The best plan is to lay open the fistula and cavity of the abscess, and touch the interior with strong tincture of iodine or nitrate of silver, and let the wound granulate from the bottom, and after a time apply the heated wire to complete the cure. Some recommend that a gum catheter should be retained, or that the patient should be

taught to use the catheter to draw off the contents of the bladder, so as to prevent the urine passing into the sinus ; but the irritation produced by the catheterism is as bad as that induced by the dribbling of urine, besides, in such cases where there is no stricture, a part of the urine always passes by the sides of as well as through the catheter. In the cases in which I have tried catheterism, it has retarded rather than expedited the cure.

In patients in whom, as a consequence of stricture, chronic abscess of the prostate gland has occurred in the form alluded to when speaking of the morbid changes following bad strictures, the pus is often discharged by ulceration through the mucous membrane lining the prostatic portion of the urethra, and consequently, when the patient makes water, part of the urine finds its way into the prostatic abscess, and leads to further suppuration, and fistulæ opening in the perineum, through which foetid pus and urine find vent. For the cure of the contraction, dilatation or other treatment of the stricture is in such circumstances indicated, but we can hardly expect it to cure the fistulous condition, depending as that does on the disorganised state of the prostate. I possess a specimen in my collection from a patient in whom a fistula in perineo existed for many years. The stricture was fully dilated and cured, but, though most of the urine passed by the natural passage, a small fistula remained open, which could never be healed. The preparation of the morbid parts shows the reason of its incurability to be the state of the prostate and prostatic portion of the urethra with which the sinus communicated. In the case of a young man recently under my care, who suffered from urinary fistula connected, not with stricture, but arising from a strumous abscess of the left side of the prostate, after having diagnosed the condition by examination from the rectum, I divided the sinus by an incision resembling that for lithotomy, and laid the cavity in the left side of the prostate freely open. The incision contracted and healed, but a similar abscess formed on the right side of the prostate, and ulcerated into the rectum. Under treatment this also contracted, but never completely, and abscess of the testicle

supervened. After long treatment the patient was dismissed relieved, but I can hardly say cured ; indeed, the state of his general health was most unfavourable for any treatment.

— In cases where great sloughing has followed extravasation of urine, it often happens that, whilst the gap caused by the separation of sloughs contracts and heals to a wonderful extent, a small fistulous opening remains. You must be very careful in your prognosis as to the curability of such a fistula. It looks so trifling that you are apt to imagine that, by dilating the stricture and touching the fistulous opening with the heated wire, there will be no difficulty in obtaining a cure. But you must recollect what has occurred. All the deep textures and a portion of the urethral wall have been destroyed, and though, by the process of cicatrisation the skin has nearly closed, it merely covers in a cavity, in which, when you pass an instrument into the bladder and enlarge the opening in the perineum, you can for an inch, or even more, feel the catheter bare. Such a case may be pronounced incurable, for the only chance of a cure is by means of a plastic operation, and the condition of parts is very unfavourable for that. I have dwelt at length on the subject of perineal fistula, because, whilst the general principle of treatment and the favourable prognosis in ordinary cases connected with stricture are in consonance with what I first stated, the exceptions are so important and so little adverted to, that I considered it essential to draw your attention to them.

RETENTION OF URINE IN THE FEMALE, owing to the short and direct course of the urethra and its large calibre, is not of frequent occurrence ; but it occasionally arises from malposition of the womb, as in cases of anteversion and retroversion of that organ, and from the pressure of firm polypi, fibrous tumours, or other growths projecting from the uterus into the vagina. I have met with complete retention, and enormous distension of the bladder, arising from accumulation of the menstrual discharge in a case of imperforate hymen. Retention of urine may also occur during labour, if the attendants neglect to have the bladder emptied

before the head of the infant descends so as to compress and alter the position of the urethra ; and it also sometimes results after tedious or difficult labours. Atony of the bladder from over-distension, or paralysis from disease of the nervous centres, may, as in the male, occasionally lead to retention, but comparatively rarely, as the size and shortness of the passage allow the urine to flow off. Stricture of the female urethra is an exceedingly rare disease, but it is occasionally met with, and most generally arises from some local injury of the passage. The orifice is not unfrequently obstructed by caruncles or warty growths, and one peculiarly painful growth, situated at the orifice of the urethra, sometimes causes complete retention of urine from sympathetic irritation, and the excessive pain caused in micturition. The growth is prominent, often pedunculated, and has the appearance of a small raspberry.

In most instances there is no difficulty in relieving retention of urine in the female by means of catheterism, but, except in cases of unusual character, no exposure is permissible, and hence the introduction of the instrument requires some tact. The direction usually given as the best to guide the instrument into the orifice of the urethra, and avoid the more patent orifice of the vagina, is to pass the finger from the vestibule backwards until the point of the finger feels the papillary swelling of the urethral orifice. In many cases where we require to use the catheter, as in women who have borne children, the urethral orifice almost lies within the dilated vagina. The surest plan in all cases is to place the forefinger of the left hand in the vagina behind the orifice of the urethra, and with the catheter carried on the forefinger of the right hand to guide the instrument into the orifice. The position of the left forefinger prevents the instrument passing into the vagina, or, if it tends to do so, detects the error at once, and then, by guiding the catheter a little forwards, it almost certainly enters the proper canal, and is easily carried on towards the bladder. A short flattened silver catheter is generally used, and answers well enough. The ordinary gum-elastic male catheter, without the stilette, will, how-

ever, I think, generally be found more useful for all purposes ; it is easily introduced, adapts itself readily to any alteration in position or length of the canal, which may be caused by the pressure of tumours or the displaced uterus, and avoids the urine wetting the patient or bed-clothes, which is liable to occur when the short catheter is used ; and, moreover, avoids still more surely all exposure of the patient.

When retention arises from some special cause, that, of course, must be attended to, besides relieving the bladder with the catheter. Thus, in the case of retained menstrual discharge, the hymen must be divided by a small crucial incision ; the opening dilated with the finger, the collected discharge evacuated, and the vagina washed out with tepid watery solution of carbolic acid, and an opiate given, as considerable irritation and even danger of metritis sometimes follows this simple operation.

When caruncles or the painful vascular wart-like growths are present, they must be removed by ligature, or the knife or scissors, and the cut surface touched with nitrate of silver. Polypoid tumours of the uterus must be removed if their character and attachments admit of that being done ; and in cases of ante- or retro- version of the uterus, means must be taken to replace and maintain the organ in its natural position.

Should an organic stricture be found, it will be best treated by gradual dilatation, or by splitting it, as in Holt's operation in the male, and then the patency of the canal must be maintained by the occasional use of a bougie or catheter.

LECTURE CXXVI.

Urethritis—Gonorrhœa Virulenta : its Progressive Symptoms—Gleet—Retrocedent Stage—Complications—Prostatitis and Irritable Bladder—Inflammation of the Testicle—Treatment of Gonorrhœa and Gleet—Gonorrhœa in the Female—Constitutional or Secondary Effects of Gonorrhœa Virulenta—Gonorrhœal Ophthalmia—Gonorrhœal Warts—Gonorrhœa Præputialis.

INFLAMMATION of the mucous lining of the urethra, attended with pain and irritation of the parts, and pain during micturition, accompanied by the discharge of viscid muco-purulent matter, may arise from various causes not venereal, such as direct local irritation, or from affections of other organs leading indirectly to irritation of the mucous membrane, constituting URETHRITIS or GONORRHŒA SIMPLEX. The term gonorrhœa was originally applied to all urethral discharges, under the idea that the irritation led to over-secretion and discharge of altered seminal fluid ; and although this erroneous notion has long ago been exploded, the term from custom is still retained.

The form of urethritis which we have to treat most frequently is an inflammation of a specific character, arising from the application of a virus to the mucous surface, and hence it is termed GONORRHŒA VIRULENTA, not on account of the virulence of the symptoms, but to distinguish it from the simple form, as arising from a special virus, and by the poison-power the discharge possesses of communicating a similar disease when applied to a mucous surface.

At one time gonorrhœa and syphilitic affections were all included under the one head of venereal diseases, a nosological arrangement which led to lamentable results in practice, from the treatment adopted, in consequence of the idea that these dis-

eases were identical in nature. In the present day, and indeed for a long period back, I believe that no one holds or has held such a view. Some, however, have gone to the opposite extreme, and consider that there is no evidence of specific character in gonorrhœa: that the disease is simply to be regarded as discharge arising from inflammatory action, and possessing the same characters whether the inflammation be excited by some accidental local irritant or by impure sexual contact.

Whilst I readily admit that any acrid discharge or other irritant of a non-venereal character applied to the urethra may excite all the acute symptoms of the inflammation and the purulent discharge, yet such an irritant will never produce certain specific symptoms which we meet with in many cases of gonorrhœa virulenta, and which are liable to occur in all, if proper treatment be not adopted. I allude especially to the peculiar lichenous eruption, and the acute or subacute forms of articular rheumatism, which frequently supervene during the retrocedent stage of the affection, and the gonorrhœal ophthalmia and otorrhœa, which occur when the discharge has ceased, or been suddenly arrested, and which cannot be accounted for on the supposition of direct application of the discharge to the part. Such constitutional affections never follow on simple urethritis, and the period at which and the manner in which they occur seem to me distinctly to indicate the specific character of gonorrhœa virulenta.

One reason why I have drawn your attention to this character of the disease is, that in gonorrhœa, as in most diseases arising from a specific virus or infection, we have it running its peculiar course, and undergoing a series of natural changes, the observation of which may form indications for, or modify its treatment. Thus, from the period of accession, we find a gradual increase in the violence of the symptoms up to the eighth or tenth day, when it culminates; and from that period the violence of the pain and amount of the discharge diminish, and the character of the discharge alters. During the retrogressive stage, affections of some of the other organs connected with

the urethra by function and continuity of mucous surface, such as Cowper's glands, the prostate and testicle, may and generally do supervene ; and, as I have already stated, it is at this period that the secondary or constitutional symptoms often show themselves.

I shall now proceed to describe, as briefly as I possibly can, the symptoms of a case of gonorrhœa virulenta. A period of incubation, varying from three to eight or ten days, seems generally to intervene between the receipt of the infection and the manifestation of the symptoms of the disease. Most generally about the sixth or seventh day the patient feels an uneasy irritable or itching sensation about the orifice and anterior part of the urethra, and on looking at the parts he observes that the lips of the orifice are red and swollen. When he passes water, the stream scatters, and micturition is followed by increased irritability of the passage. The irritable sensation soon changes to that of pain of a sharp burning character, and then there is noticed a purulent discharge, at first small in quantity, but which soon becomes profuse. The inflammatory swelling of the orifice is increased, and there is often swelling of the prepuce from acute œdema. The pain on micturition is now so intense and burning in its character, that the patient dreads to relieve the bladder, and in some cases the agony is excessive. The constitution sympathises, and there is always more or less fever and disturbance of other functions, while in some patients the symptomatic fever runs very high. Little hard masses and inflamed absorbents can often be felt along the penis, and the absorbent glands in the groin are swollen and painful. The burning pain and profuse purulent discharge continue unabated for eight or ten days, and then the pain begins to be less severe, and micturition is not attended or followed by such intense suffering. Gradually the discharge becomes thinner and less in quantity, and in some instances it may become suddenly arrested.

A new train of symptoms now develop themselves : the swelling and irritation near the orifice of the urethra disappear,

but the patient begins to feel an uneasy irritable condition in the perineum, and then a feeling of weight and itching about the anus and lower part of the rectum. At night the patient is often awoke by a painful erection of the penis, the organ is tense from engorgement, and curved downwards, constituting the condition termed *Chordee*. The erection evidently depends upon irritation of the prostatic portion of the urethra, the reflex effect being excitement and erection of the penis, which, in the inflamed state of the mucous membrane, gives rise to intense pain by stretching still further the swollen and inflamed membrane.

The pain on micturition is generally very slight after the first fifteen days, but the discharge may continue to be considerable in amount and of purulent character for a much longer period. In some instances it seems to disappear, and then, without any obvious cause, to re-appear. This is most usually observed in persons of delicate or lymphatic temperament, or in those who have had gonorrhœa previously. In such cases the painful symptoms are less marked, but the progress of the disease is generally tedious, and most frequently terminates in gleet.

By the term GLEET, strictly applied, we mean a thin viscid and clear fluid discharge from the urethra; but the word is often made to include chronic thin purulent discharge in obstinate cases of gonorrhœa. There are few conditions more annoying to the patient and the surgeon than gleet. In many cases it baffles all our remedial measures, and often, when it has yielded to remedies, it re-appears whenever they are left off. Gleet seems to depend not only on the chronic inflammation of the mucous surface, but also apparently on an affection of the mucous follicles, increasing the discharge by over-secretion of thin mucus; and occasionally these follicles, or Cowper's glands, suppurate and give rise to troublesome complications, such as urinary fistula. In cases where the patient has previously suffered from attacks of gonorrhœa, when gleet is very obstinate, it is advisable to

examine the urethra with a bougie, as not unfrequently the irritation causing gleet is kept up by the presence of a stricture.

When gonorrhœa is passing off it becomes retrocedent. The prostatic portion of the urethra becomes affected, and if the patient, thinking himself better, is imprudent, or so reckless as to indulge in any debauchery, acute abscess of the prostate may occur. This is attended with intense pain, and weight in the perineum, congestion and protrusion of the mucous membrane of the rectum, like hemorrhoids, and sometimes the serious mistake is made of treating the hemorrhoidal swelling by ligature, as being the cause of the symptoms. More generally, as the discharge ceases, the patient becomes affected by swelling of the testicle—ORCHITIS, or HERNIA HUMORALIS. He complains of pain in the loins like lumbago, becomes feverish and nauseated, and the urine is scanty and high coloured. By and by pains of an acute character shoot along the inguinal canal, then intense pain is felt in the epididymis and spermatic cord, and the testicle becomes greatly swollen, tense, and painful. As the swelling increases, acute œdema of the scrotum occurs, or more generally effusion of serum takes place into the tunica vaginalis, constituting acute hydrocele, and from the vessels thus relieving themselves the tension and pain in the testicle is diminished. When under treatment resolution is effected, the swelling, tension, and pain gradually disappear, and the symptomatic fever passes off. In most cases, however, hardness of the epididymis remains for a long time, and in some cases continues throughout after-life.

During the retrocedent stage of gonorrhœa, irritation of the bladder, of a very acute character, frequently supervenes, and is, I believe, often induced by the use of cubebs in large doses. There is considerable pain in the bladder, almost constant desire to pass urine, only very small quantities being passed at a time with great straining and severe smarting pain at the neck of the bladder. If this condition be not soon relieved by appropriate treatment, spasm and engorgement of the textures at the neck of the bladder and around the urethra speedily lead to complete

retention of urine, which, under the above-mentioned conditions, is attended with excessive suffering.

The *Treatment* of gonorrhœa depends on the stage of the disease when we first see the patient, and also on the state of the constitution. In the very early stage of gonorrhœa it has been proposed to cut short the disease by injecting a strong solution of nitrate of silver into the urethra. This is what is termed the *Ectrotic* or *Abortive* treatment. The latter term, in one sense, designates it best, for it almost invariably fails in effecting the purpose intended, and, from what I have seen of cases in which it had been tried, it frequently excites great irritation in the urethra, and leads to abscesses in the prostate, and lays the foundation of affections of the genito-urinary organs, which may ultimately destroy life by irritation and exhaustion.

My limits forbid me entering on a consideration of the many plans of treatment or remedies recommended in this disease, and I shall therefore state briefly the method which, from experience, I believe to be most generally suitable and efficacious.

In the very early stage, when the discharge is just beginning, the bowels should first be cleared out by some bland laxative, such as a dose of castor oil, and then regulated by the use of bicarbonate of potash and rhubarb—drastic purgatives should never be given. The patient should be kept as quiet as circumstances will permit, and the diet should be light and unstimulating. Acetate of potash, in ten grain doses in camphor mixture, should be taken twice a-day, and hyoscyamus may be added if the pain be very great. The parts should be kept very clean, and bathed with some mild alkaline solution. A weak injection of tannin, thrown into the urethra, may be used with advantage, but no stimulating injection should be used in this stage. The patient should drink freely of thin barley water or linseed tea, or the old-fashioned but useful remedy, five-grain doses of nitrate of potash, combined with powder of gum arabic, dissolved in water. If he wishes to avoid taking such remedies

lest he incur suspicion, he may drink aerated potash, or seltzer waters.

After the discharge has become thick and muco-purulent, we may begin the use of the specific remedies, such as cubebs or balsam of copaiva. In my own practice I generally begin by exhibiting the balsam of copaiva in doses of fifteen drops, thrice a-day, either by itself or in the form of emulsion, combined with tincture of hyoseyamus, liquor potassæ, and some mucilage, afterwards the dose of the balsam may be increased, or it may be combined with cubebs and henbane into a paste, of which the patient takes a bolus thrice daily. In cases where the discharge continues longer than usual, or where the patient has had previous attacks, a grain or two of tannin or powdered alum may be added to each dose of the paste. As to local applications, at first, acetate of lead lotion may be applied to bathe the glans penis, and to the inflamed orifice of the urethra, and subsequently in weak solution with acetate of morphia it may be injected into the passage. In using this, or any other form of injection, the canal should first be washed out by injecting tepid water. Should pain and swelling of the inguinal glands occur, rest is absolutely necessary, together with the local application of acetate of lead lotion to the swollen glands. My experience is, that suppuration rarely occurs in such swollen glands in gonorrhœa, but these precautions are requisite to prevent the risk. If chordee supervenes, the use of an opiate suppository at bedtime, or an enema of iced water, and a camphor and hyoseyamus pill at night, are the best means of preventing this painful symptom. When an attack does occur, plunging the organ into cold water is the best means of affording temporary relief.

When, during the retrocedent stage, symptoms of prostatitis and irritable bladder supervene, the use of cubebs and the balsamic remedies should be left off, and camphor and henbane, either in emulsion or in the form of pill, substituted, and the patient should drink freely of diluents; and after the bowels have been cleared out by a dose of castor oil, an opiate, enema, or suppository, should be administered. If the patient be young

and robust, and the symptoms acute, great relief will be experienced from the application of leeches to the verge of the anus. Of course, under these circumstances, the most absolute rest is necessary.

The most troublesome stage, or rather consequence of gonorrhœa, is the chronic form of discharge termed gleet. It often baffles all remedies for a time, and runs its own course in spite of them. This condition is, I believe, most likely to be prevented by commencing the use of astringent and slightly stimulating injections when the discharge of gonorrhœa becomes thin, and the pain in micturition has nearly disappeared, and it is at this stage that I think the use of cubebs in moderate doses, along with eight or ten drops of the muriated tincture of iron, diffused in a large proportion of water, is most beneficial. At the same time the strictly antiphlogistic regimen, necessary in the acute stages of gonorrhœa, should be relaxed, and some wine allowed, at first in small quantity, but gradually increased unless it re-excite the pain. When gleet is fairly established, the remedies, local or constitutional, most generally useful are those of a tonic or stimulating character. Internally, the use of cubebs and iron, or of sulphate of zinc in doses of one or two grains twice a-day, combined with Chian turpentine, and extract of gentian, are what I find most serviceable. In some patients I have found sulphate of quinine act beneficially. Zinc and alum injections, and occasionally passing a bougie, are the local remedies in which I have the most confidence.

Gonorrhœa in the female differs in some respects from the disease in the male, both in regard to its symptoms and treatment. In the female the disease may be, and often is, confined to the vagina, and as that passage has no necessary connection with the urethra, the symptoms are often only heat and pain in the vagina, and swelling of the vulva, followed by the purulent discharge, and unless the urethra becomes affected there is no heat or pain in micturition, nor any other affection of the urinary organs. When these organs, however, do become affected, then of course all the symptoms of urethral inflammation occur as in

the male, and are even intensified. The conditions just alluded to modify the treatment. In vaginal gonorrhœa the treatment is almost entirely local, and consists in washing out the passage with mild alkaline lotions and then injecting solution of acetate of lead and opium, and applying lint soaked in the solution to the vulva, and when the more acute symptoms pass off, using zinc and alum injections to arrest the discharge. Remedies such as balsam of copaiva or cubeb pepper, which are considered specifics in the male, exert no influence in the cure, as they act on the urinary organs, and do not affect the vagina. But they are required if the urethra becomes affected.

In speaking of the general characters of gonorrhœa virulenta, I mentioned the secondary constitutional affections which often follow it—the lichenous eruptions and rheumatic symptoms. When these supervene, we should leave off the balsamic remedies and cubebs, and have recourse to small doses of the nitrate of potash, colchicum wine, and diaphoretics, and the occasional use of the alkaline warm bath, or the vapour bath in bed may be substituted, to avoid the risk of the patient being chilled after the bath. As the more acute symptoms pass off, the iodide of potassium may be given with advantage.

One of the most serious affections following gonorrhœa is gonorrhœal ophthalmia. It may arise from the patient inadvertently touching the eye with the gonorrhœal discharge; but it arises as a constitutional affection independently of such cause. The disease is characterised by extreme vascular congestion, and bright redness of the conjunctiva, the sub-conjunctival cellular tissue becomes infiltrated and swollen, leading rapidly to chemosis, infiltration, and swelling of the eyelids and purulent discharge. The cornea is very liable to suffer at an early period owing to the pressure and interference with its nutrition. It becomes opaque from effusion between its layers, and ulceration or sloughing may result. The treatment requires to be very active. The chemosed conjunctiva should be snipped to allow the infiltration to escape, and to relieve the congested vessels; the swollen conjunctiva of the eyelids should be snipped or

scarified for the same purpose, and the conjunctival surface painted over with a solution of nitrate of silver, or a strong solution of alum; leeches should be applied to the temples and a blister behind the ear, and strict antiphlogistic regimen enforced. In milder forms, the solution of nitrate of silver or alum to the conjunctiva to arrest the purulent discharge, combined with the use of saline purgatives, is in general sufficient to relieve it. When the sclerotic coat of the eye or the iris becomes affected, the use of calomel and opium, and the local application of belladonna or atropine, must be used in addition to antiphlogistic remedies, on the general principles of treating scleratitis and iritis.

The irritation caused by the gonorrhoeal discharge sometimes leads to the formation of warts on the prepuce and glans penis. I believe that attention to cleanliness, and washing the parts frequently with some mild alkaline lotion, will do much to prevent such formations. They occur, indeed, in their most exaggerated form, in females, in whom, from the constant discharge lodging on the nymphæ and vulva, and passing back from the vagina, we frequently find enormous masses of warts occupying the perineum and around the orifice of the anus. In the early stage of these warty excrescences, the application of nitrate of silver, strong acetic or chromic acid, is sufficient to destroy them, and if alkaline lotions be subsequently used, their extension will be prevented. When large, pendulous, and prominent, they must be clipped off, and the cut surface, and any incipient vegetations, touched with nitrate of silver.

We occasionally meet with a discharge of purulent matter from the lining membrane of the prepuce, and the surface of the glans penis—*GONORRHOEA PRÆPUTIALIS*. The prepuce is swollen, cedematous, and painful, and the discharge is of a greenish-yellow colour, and has a peculiarly offensive odour. The sebaceous secretion seems to be altered in character, and increased. There is no pain on micturition, but considerable tenderness of the glans penis. The treatment required is purely local. Alkaline washes should be injected between the glans and prepuce,

or, if the latter can be drawn back, applied directly to the parts ; the affected surfaces should then be painted over with a solution of nitrate of silver. These measures generally serve to arrest the discharge and effect a cure ; or if the discharge continues it is less offensive, and the use of sulphate of zinc and alum lotion are sufficient to complete the cure. In cases where the prepuce is inflamed, swollen, and cedematous, the acetate of lead and opium lotions should be applied to the part to allay the swelling, and the alkaline and astringent lotions injected beneath the prepuce to arrest the discharge. Beyond antiphlogistic regimen, no constitutional treatment is required.

LECTURE CXXVII.

Phymosis and Paraphymosis : Treatment—Orchitis or Inflamed Testicle : Treatment—Hydrocele : Diagnosis and Treatment ; Operation—Hæmatocele : Difficulties in Diagnosis ; Treatment—Circoscele and Varicocele ; Diagnosis and Treatment—Tumours of Testicle—Castration : Steps of the Operation and points to be specially attended to.

DURING the progress of gonorrhœa the irritation caused by the disease may induce the affections of the prepuce, termed phymosis and paraphymosis ; but as these conditions arise also from other causes, we may as well consider them in their general character.

The condition termed PHYMOSIS consists in the prepuce being elongated, closing in the glans penis, its orifice being contracted and thickened, so that it cannot be drawn back to uncover the glans. Phymosis frequently occurs in children as a congenital condition, and is, except under some accidental circumstances, unattended by swelling or inflammation. But when it supervenes on gonorrhœa or syphilis, the prepuce is swollen, hard, and its margin slightly œdematous. In such

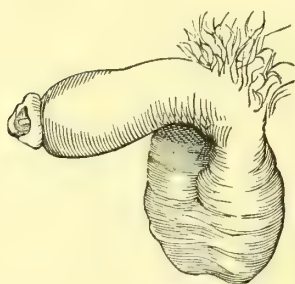


Fig. 42.

circumstances, by the use of acetate of lead lotion, and injecting tepid water beneath the prepuce, the swelling diminishes, and the glans penis can be exposed. If this condition, however, has been permitted to exist till consolidation of the inflammatory swelling has taken place, the discharge is apt to collect beneath the prepuce, and give rise to abrasion of the opposed surfaces, and partial adhesion may take place between the glans and lining

membrane of the prepuce, or the foreskin may ulcerate or slough. When we are called to a patient under such circumstances, we must slit up the foreskin to such an extent as to be able to uncover the glans. To effect this, we take an ordinary director, pass it between the glans and prepuce as far up as the reflection of the lining membrane, bring the director close to the side of the frænum, then carry a sharp-pointed, curved bistoury along the groove of the director, transfix the skin at the point of reflection, and slit the prepuce freely open. In many cases, when this is done, it will be found advantageous to clip off the thickened and altered foreskin, so as to effect complete circumcision. A few stitches may require to be inserted to diminish the cut surface.

In cases of congenital phymosis, circumcision should always be performed. This is sometimes done by pressing back the glans penis, and then seizing the anterior part of the foreskin between the blades of a pair of dressing forceps, and clipping off the projecting part of the prepuce ; but this method is very imperfect, the skin and lining membrane of the prepuce are very loosely connected, and the latter is closely applied, almost adherent to the surface of the glans ; hence, when the projecting portion of the foreskin is cut off, you must slit up the lining membrane, and cut it off subsequently. It is better to proceed in the manner described in the case of acute phymosis ; that is, to slit up the prepuce to the point of reflexion, and then clip it off with scissors. In this case, however, we must recollect that it is essential to stitch the cut edges of the skin and lining membrane, to prevent their separation. Ice or iced water dressing should be applied to prevent oozing, and the cut margins of the prepuce protected by the application of a little oil when the patient passes water.

PARAPHYMOSIS consists in retraction of the prepuce, which becomes swollen. The sharp and unyielding cutaneous margin becomes tight, and constricts the penis behind the glans. The mucous lining is swollen and œdematous, in consequence of

infiltration of the loose submucous tissue. When we examine the part we find two swellings with a deep narrow sulcus between them.

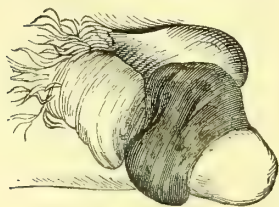


Fig. 43.

In front there is the swelling caused by the mucous lining of the prepuce and the glans penis; posteriorly, the swollen and inflamed integument of the prepuce; and on separating the swellings we perceive at the bottom of the intervening sulcus the tight constriction caused by the un-

yielding margin of the prepuce. In the treatment of paraphimosis we must remember that, unless the condition be relieved, strangulation of the constricted parts will be the result, and sloughing not only of the prepuce, but even of the glans penis, may occur. We must therefore be prompt in our measures of relief. If called to the patient in the early stage; by puncturing the œdematous swelling in front, and by compressing the glans penis with one hand whilst we draw forward the prepuce with the other, we often succeed in removing the malposition of parts. But if there is any difficulty, the operation required for paraphimosis is so simple and so slight that we should have recourse to it at once. The operation consists in separating the two swellings, so as to expose the constriction at the bottom of the sulcus, and then with the point of a tenotomy knife or narrow bistoury notching the constricting ring deeply at two or three points of its circumference; this at once relieves the constriction, and the prepuce is easily replaced, and when this is accomplished, the marks of the knife can scarcely be perceived. The so-called operation is really less painful and less likely to injure the parts than attempts at reduction by pulling forcibly on the prepuce. Cold-water dressing, to allay excited action, is all the after-treatment which is required.

Inflammatory swelling of the testicle—Orchitis, or *Hernia Humoralis*, as it is sometimes termed—arises from various causes, but perhaps more frequently during retrocedent gonor-

rhœa than from any other. I have already described the mode of invasion and character of its symptoms when it results from gonorrhœa, and as these are the same from whatever cause the disease arises, I need not repeat them here, but shall simply state the treatment most suitable for its cure.

The plan of treatment most generally useful is to deplete at the first by opening one or two of the small scrotal veins, and immersing the testicle in moderately warm water to encourage the bleeding, which is afterwards arrested by a bit of adhesive

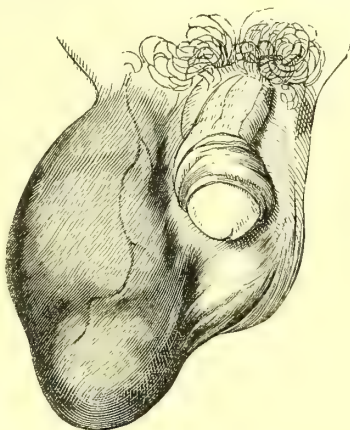


Fig. 44.

plaster, and the patient is made to remain in the recumbent posture, with the scrotum supported on a cushion, while lint dipped in slightly tepid anodyne lead lotion is applied over it. The bowels should be kept gently open, and the diet should be strictly antiphlogistic. If the disease occur during retrocedent gonorrhœa, all specific remedies should be abandoned, and camphor mixture, aerated potash water, and other diluents substituted for them.

In many cases effusion takes place into the tunica vaginalis, constituting acute hydrocele, and great relief is given by puncturing the distended sac, and so relieving tension. In some cases I have made small incisions into the swollen testis, with great relief, and without any bad after effects; but I have not carried out the practice, as I am impressed with the belief that the risk of exciting irritation more than counterbalances the relief which the incisions afford at the time. In many instances, if we see the case at the commencement, compression of the testicle by methodical application of adhesive strapping will often prevent the accession of swelling, and cure the disease; and, in all cases, the strapping applied after the painful symptoms are subdued, is

useful in obtaining the speedy absorption of interstitial exudation, and so preventing permanent organic change in the gland or epididymis; and for the same purpose I think it is generally advisable to give a few doses of grey powder, or one-grain pills of the green iodide of mercury, during the progress of the treatment. If any hardness of the epididymis continues, a little iodine or camphor and mercurial liniment may be applied, rubbed in over the swelling.

HYDROCELE OF THE TUNICA VAGINALIS consists of a collection of serous fluid within the cavity of that sac. The scrotum gradually becomes distended, and the swelling passes up in front of the spermatic cord towards the external abdominal ring. The collection of fluid forms a tumour, generally of a pyriform shape, perfectly smooth on the surface, and unattended by any painful symptoms except the dragging sensation caused by its weight and bulk. The history of the disease is that of slow gradual increase from below upwards. The testicle can be felt at first at the posterior part of the swelling, but its relation is lost as the fluid collects and overlaps it.

The disease may follow some injury or irritation of the genito-urinary organs; but, for the most part, no distinct cause can be assigned for its origin. It is a disease of common occurrence in all countries, but is especially frequent in warm climates. The diagnostics of hydrocele are—its form, and the manner in which the swelling takes place, its weight as compared with solid tumours, the feeling of tense fluctuation, and the transparency of the swelling when we examine it by transmitted light, by which last test we at once satisfy ourselves of the nature of the contents of the swelling, and see the relative position of the cord and testicle.

When speaking of the diagnosis of scrotal hernia, I have already fully described the differential diagnosis of these two diseases, and need not repeat it here. It may, however, be mistaken for other tumours of the scrotum, or other swellings may be mistaken for it, more especially medullary tumours, which

have a feeling of elasticity not unlike fluctuation. Such tumours, of course, are not transparent when the light test is used ; but then, in some instances, hydrocele, owing to the density of the tunica vaginalis, is also opaque ; and unless care be taken, in applying the light test, to keep the ulnar side of the hand closely applied to the scrotum, the reflected light of the taper on the convex surface of the swelling may be mistaken for transparency. As a general rule, however, the diagnosis is not difficult, if we take all the circumstances of the case into account. In young children, and even in other cases when the hydrocele passes high in front of the cord, it is advisable to place the patient recumbent, and try whether the fluid can be pressed back into the abdomen, as it occasionally happens that a narrow canal of communication with the peritoneal sac continues pervious ; and this would alter our mode of treatment.

The fluid in hydrocele is of a pale straw colour, and frequently we observe sparkling or oily-looking particles floating in it ; this is cholestrine. In some cases having all the ordinary symptoms of hydrocele, the fluid drawn off is colourless and slightly opalescent, and, on examination with the microscope, we find spermatozoa in it. This constitutes what is termed *Spermatocele*. In its general symptoms it in no respect differs from hydrocele, except that it seldom attains so large a size, and the treatment is the same in both forms of disease.

The *Treatment* is either palliative or radical. The former consists in tapping the distended sac with a trocar and canula, and drawing off the fluid from time to time, so as to alleviate the dragging and uneasy feelings produced by the swelling. This is done in cases where, from the state of the testicle, or owing to a communication with the peritoneal sac still remaining open, the radical cure is unadvisable. The radical cure is best effected by tapping the sac, as in the palliative method, and, when all the serous fluid is evacuated, injecting two or three drachms of strong tincture of iodine, shaking the scrotum so as to bring the iodine in contact with all parts of the affected serous surface, to create excited action. The part becomes in some

hours as much swollen as before the procedure, but the swelling is inflammatory, and a change of action in the serous sac is induced, which prevents re-accumulation of the fluid. It was formerly supposed that adhesive inflammation and obliteration of the sac followed the injection of irritating fluids; but where opportunities have occurred of examining the parts in patients who had undergone the operation, adhesions of the opposed serous surfaces have seldom been found to be extensive, and frequently none exist, so that we must account for the cure by supposing some change of action to be induced by the stimulation of the membranes. In cases where the ordinary method fails, which it does occasionally, then we must resort to the old operation of laying open the sac freely, removing a portion of it, and dressing the exposed surface with slips of lint soaked in some stimulating lotion, and allowing the remains of the sac to granulate and consolidate.

The *Operation* for the cure of hydrocele is very simple. The instruments required are a small trocar and canula, and a small



Fig. 45.

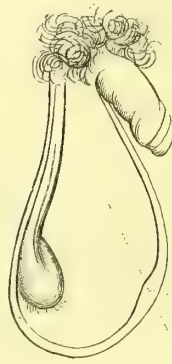


Fig. 46.

graduated glass syringe, with a brass nozzle to fit the canula, for the purpose of injecting the tincture of iodine. The scrotum is kept tense, and the position of the testicle ascertained. The sur-

geon then plunges the trocar perpendicularly (*a*) through the scrotal coverings, at the most prominent part, till he feels it enter the sac, then he changes its direction, and makes it pass obliquely upwards, to avoid injuring the testicle (*b*, Figs. 45 and 46). When the sac is fairly emptied of fluid, the iodine is injected, and the syringe and canula withdrawn at the same time. The patient should then be placed in bed, with the scrotum supported. Should the inflammatory swelling be slow of disappearing, stimulant evaporating lotions should be applied to hasten its discussion.

HÆMATOCELE, as the name implies, is a collection of blood or bloody fluid. It may arise from an injury rupturing or penetrating the tunica vaginalis, and blood distending its cavity; but true hæmatocele in the scrotum generally results from slow changes taking place in a hydrocele. The tunica vaginalis becomes remarkably altered in structure, greatly thickened, and of fibrous or even fibro-cartilaginous consistence, and occasionally loaded with earthy deposit, or ossified, as it is termed. The interior surface is also altered, congested, and flocculent; and, in general, a mass of fibrine or decolourised clot is found at the lower part of the cavity. The fluid contents, in case of true chronic hæmatocele, are usually of a dark-brown colour like porter, and, as in the case of hydrocele, cholestrine is usually found in the fluid. The diagnosis of hæmatocele is not so easy as that of hydrocele, for in hæmatocele we have no translucency, whilst the weight and the doughy, or even hard feeling, communicated by the coagulum which forms part of its contents, render more difficult the distinction between it and tumours of the testicle. We must trust, therefore, more to the history of the case and the general aspect of the patient than to the local conditions by themselves, to guide us aright. Fortunately, the treatment which requires to be adopted in hæmatocele enables us to make sure of the true nature of the disease; and, should the swelling prove to be a tumour of a more serious character, we can then proceed to remove it at once.

The *Treatment* of hæmatocele consists in making a free inci-

sion into the tunica vaginalis, evacuating its contents, and then removing as much of the anterior and lateral walls of the sac as we can without injury to the testis and cord ; and, if the scrotum is much distended, a portion of it may also be removed with advantage. After all bleeding vessels have been secured, the surface of the portion of the sac which has been left is brushed over with a solution of perchloride of iron, or spirit of turpentine, and slips of lint or charpie laid lightly in the cavity. Subsequently, as suppuration and granulation proceed, the dressings must be conducted on the general principles applicable to all granulating surfaces. In those cases where the tunica vaginalis is ossified or cartilaginous, the testicle is compressed and atrophied, and so connected with the altered texture that its function is destroyed. In such cases, the best plan of treatment is to remove the whole mass, along with a portion of the scrotum, by castration. In cases where a large part of the contents of the sac is fluid, you might be tempted to draw it off, but such a procedure is almost invariably followed by decomposition and putrescence of the remaining semi-solid contents of the sac, exhalation of fœtid gases, and formation of purulent matter, the presence and confinement of which give rise to intense irritative fever. When such practice has been adopted, and these conditions supervene, no time should be lost in laying the cavity freely open, washing it out with Condyl's fluid, and subsequently with carbolic lotion, and applying charcoal poultices over the parts ; at the same time using the general treatment necessary to allay the constitutional irritation.

The disease termed CIRSOCELE is varix of the spermatic veins. VARICOCELE is also sometimes used to denote that condition, as well as a general varicose state of the scrotal veins. There should seldom be any difficulty in arriving at a correct diagnosis of this affection. The tortuous distorted veins, and their relation to the cord and testicle, are in general sufficiently obvious, whilst the feeling they communicate to the fingers when grasped, and impulse given to the blood contained in them

when the patient coughs, are so peculiar as scarcely to be mistaken. I have already discussed the diagnosis between this disease and scrotal hernia, and pointed out that the diagnostic chiefly to be trusted is, that if after reduction of the swelling, when the patient is recumbent, pressure be made over the inguinal ring, and he then assumes the erect position, in the case of a cirsocele the varicose veins will rapidly become tense, whilst a hernia would be retained by the pressure of the fingers. Cirsocele is generally met with in young men, and frequently causes great mental anxiety and depression, in consequence of the idea that it may lead to impotence. It is possible that very great distension of the veins, long continued, may give rise to conditions leading to atrophy of the gland ; but though the disease is very common, such a result is so rare as scarcely to be considered as a probable one ; and, moreover, we not unfrequently find, that without any treatment the condition passes off as a patient grows up. In many cases, by allaying sources of irritation in the genital organs, we effect a gradual cure with scarcely any local treatment. As a general rule, I am very averse to advise any treatment beyond cold bathing to the genital organs, and the use of a light suspensory bandage ; but, in some cases, where the enlargement of veins was very great, and gave rise to great pain in the testicle, I have used acupressure to the veins principally affected, with advantage, and in several complete cure has followed. In other cases, where the skin of the scrotum was much relaxed, I have removed a portion of the scrotal integuments, and the subsequent contraction has afforded considerable relief, although in some instances only for a time. The class of cases to which the back lever vein truss is applicable are those where, from some obstruction to the venous circulation within the abdomen, the column of blood from above presses down upon and distends the veins of the cord and scrotum ; and the action of the truss is intended not to interrupt but to modify the circulation. A strong suspensory bandage should always be worn at the same time. In ordinary cases of cirsocele the truss would be hurtful. Whilst I mention the treatment which some special

cases may require, I repeat, that in the great majority of cases of cirsocele, all that is generally required or warrantable is, to use means to allay all sources of excitement and any irritation in the urethra, to use cold bathing to the genital organs morning and evening, and to support the scrotum by a well-made suspensory bandage.

The TESTICLE is frequently the subject of tumour-growth, both of the simple and malignant forms. Unfortunately the latter are the most common. The simple growths affecting the testis are—*simple sarcoma*, *fibrous* and *fibro-cystic* tumours. The malignant are generally of the medullary form, either ordinary *cerebriform* or *vascular medullary sarcoma*, *fungus hæmatodes*. *Scirrhus*, so common in the female breast, is exceedingly rare in the testicle.

These diseased conditions of the testicle are distinguished by the same general vital manifestations and local appearances which I described when speaking of tumour growth; and by attending to these we are able to diagnose the nature of each case, and to adopt the appropriate treatment. To describe each different form of tumour of the testicle would be to repeat what has already been discussed in the earlier part of the course. In all true tumours of the testicle, whether simple or malignant, removal of the tumour by castration is necessitated. In the case of malignant growths we must make sure that the cord is healthy, at a point where we can divide it, and that the inguinal glands are not affected by the disease.

If there be nothing to contra-indicate the operation, CASTRATION is performed as follows:—The groin and scrotum having been previously shaved, the operator grasps and slightly raises the diseased testicle with his left hand, and renders tense its scrotal coverings. He then commences his incision through the integuments over the cord, a little above the external abdominal ring, and carries it down to the upper part of the tumour, where he makes it diverge first to

one side and then to the other, so as to mark out for removal a large elliptical portion of the scrotal integuments. These incisions should be carried deeply through the coverings to the tumour. The surgeon next clears the cord at the upper part of his incision, and cuts through the fibres of the cremaster, and separates the cord thoroughly, so that his assistant can grasp it firmly between his finger and thumb, above the point where it is to be divided. By taking these precautions, there is no fear of the cord being retracted or slipping. Of late I have in several instances secured the vessels of the cord, and prevented retraction, by passing an acupressure needle beneath the vessels, and compressing them with the wire loop. When the cord is thus secured, the operator divides it, and then, unless any unusual adhesions exist, the testicle, along with the elliptical portion of integument marked out by the incisions, is turned out by a few touches of the knife; indeed, the loose connections of the tumour to the scrotum scarcely require the use of the knife after division of the cord. To commence by dissecting the testicle from the scrotum before dividing the cord is to prolong the operation unnecessarily.

If acupressure of the cord has been adopted, then the only vessels which require ligature will be the large branch of the inguino-pudic artery, which will be readily found at the upper and outer part of the scrotal incision, and the numerous scrotal twigs of the superficial perineal artery at the lower part of the scrotum. The parts should be thoroughly cleansed by pouring first tepid and then cold water over the open wound, which should afterwards be brushed over with spirit of turpentine, to arrest all oozing, and act as an antiseptic. The margins are united by points of suture, the lowest sutures being left untwisted for a few hours to allow any oozing of blood to escape. The patient is then placed in bed, with the thighs slightly separated, and the scrotum supported on a pillow formed of tow or oakum, covered with gutta-percha tissue. A piece gutta-percha tissue is also laid over the wound, and an ice-bag applied over it, and frequently changed. This application of dry

cold I use in all cases of excision of tumours, and find that it obviates oozing of blood, and keeps the local action within due bounds. It must of course be watched as to its effects, for in some instances it may prove too depressing, and interfere with union.

Removal of a very large tumour of the testicle can be effected easily by a single longitudinal incision of the scrotum ; but it is always, I think, advisable to remove a very considerable portion of integument, to diminish the cut surface left, the number of vessels requiring to be secured, and the risk of reactionary oozing of blood, whilst the removal of the loose skin also facilitates primary union.

Besides tumours of the testicle, properly so called, we meet frequently with simple chronic enlargement of the gland, which in general yields more or less readily to strapping with adhesive plaster, or friction with mercurial and camphor liniment, or iodine liniment, combined with the use of internal deobstruent medicines, such as iodine, or a mild course of mercury. In some instances the swelling is obstinate, and proves a source of annoyance to the patient, and then castration may be war-rantable, but not until a fair trial has been given to other means.

LECTURE CXXVIII.

Syphilitic Hydro-Sarcocele : Dangers of Operation in such Cases—Scrofulous Testicle—Sinuses and Abscesses—Fungoid Scrofulous Testicle : its True Nature : Methods of Treatment—Irritable or Neuralgic Testicle—Elephantiasis Scroti : Operations for its Removal—Soot-Wart, or Chimney-Sweep's Cancer : Treatment—Epithelioma of Prepuce and Penis—Amputation of the Penis—Diseases of Genito-Urinary Organs in the Female—Ovarian Disease—Ovariectomy—Vesico-Vaginal Fistula, and Operation for its Cure—Suture of the Female Perineum.

IN cases of patients affected with tertiary syphilis, we not unfrequently meet with a hard indolent enlargement of the testicle, combined with hydrocele—**SYPHILITIC HYDRO-SARCOCELE**. This condition is one in which you must be very cautious in having recourse to removal of the testicle, when the disease occurs in a cachectic person, or one past middle life. In such cases I have seen a low unhealthy form of gangrenous erysipelas attack the wound, and diffuse infiltration take place along the cord, and lead to fatal results. Puncture of the hydrocele and injection with iodine do good, if assisted by internal remedies but removal of the testicle under the peculiar state of the constitution I consider to be hardly warrantable.

In scrofulous patients subacute orchitis frequently terminates in suppuration in the substance of the gland, and gives rise either to extensive sinuses and small suppurating cavities in the gland, or to a larger ulceration of the tunica albuginea and scrotal coverings at some point, followed by the protrusion of a fungus of very formidable appearance. This latter condition is termed the **SCROFULOUS FUNGOID TESTICLE**.

The treatment of sinuses in the substance of the testis con-

sists in dilating their external orifices freely, and injecting a little tincture of iodine along their track, and then compressing the testicle by adhesive strapping. In cases where this fails to effect its object, we must fairly slit up the sinuses, and treat them as ordinary sinuses. When the gland is traversed by sinuses in all directions, with small depots of unhealthy pus in its substance, the function of the organ is destroyed, and the least painful and most effectual treatment is removal, and this should be done before the gland becomes largely adherent to the scrotum, as the operation then becomes much more difficult and tedious.

At one time the fungoid testicle was looked upon as a malignant disease, and castration was resorted to for its removal. Sir William Lawrence pointed out that the disease was quite different in character from malignant fungus, and that by shaving off the more prominent part, and applying some mild escharotic or stimulant astringent wash, the skin would heal over it, and that, therefore, castration was not required. Following out a suggestion of Professor Goodsir's, who found that the protruded part contained the healthy tubular structure, merely separated by interstitial deposit of lymph, the late Professor Syme proposed to save the protrusion by dissecting the surrounding integuments of the scrotum, and bringing them over the fungus. The pressure of the integuments, and the excitement following the operation, led to gradual absorption of the interstitial deposit, and the gland was thus saved. I have frequently performed this operation, and always with success, so far as repression of the fungus was concerned; but in several cases the gland saved soon became so atrophied, that I should doubt if its functions were retained. Still, in many instances, it does succeed perfectly, and is in all cases preferable to castration. But in cases where the patient is very weak, or where there is a syphilitic taint, hereditary or acquired, I would advise the method proposed by Sir William Lawrence as preferable to the more severe operation, as in such circumstances the dissected scrotal integument is apt to be affected by unhealthy action, instead of uniting over the protrusion.

NEURALGIA OF THE TESTICLE, or IRRITABLE TESTICLE, is an excessively painful affection, but scarcely admits of surgical treatment. Castration has occasionally been had recourse to as a last resource, when the intensity of the suffering was unbearable, but the remedy is hardly warrantable, for the relief is only temporary. The divided cord becomes the seat of neuralgic pains, or the opposite testicle is soon affected ; and in some few cases, where the painful symptoms were cured, the patients, forgetting their former sufferings, have reflected on the surgeon for yielding to their importunities for relief and removing the testicle. The remedies most generally useful as palliatives are the application of blisters over the lumbo-sacral region, the cold douche to the spine, and cold baths to the genital organs, together with proper constitutional treatment by means of chalybeates and quinine, and taking great care to prevent accumulation of fæculent matter in the large intestine. In some cases marked benefit follows the use of Lallemand's cautery applied to the prostatic portion of the urethra.

HYPERTROPHY or ELEPHANTIASIS OF THE SCROTUM, though of rare occurrence in this country, is occasionally met with, and in warm climates the affection is not uncommon. The whole integuments of the scrotum are swollen, thickened, and altered in structure, so as to form an enormous tumour, in which the penis and testicles are deeply imbedded, the integuments of the prepuce, hypertrophied and covered with indurated excrescences, alone remaining visible, as shown in the woodcut on the following page.

In such cases the only remedy is removal of the whole tumour, which, as it is a simple hypertrophy, has no tendency to return. Such operations are attended with great risk from the immediate loss of blood, and therefore, except when the tumour is comparatively small, it is scarcely admissible to attempt any dissection for the purpose of saving the genital organs, but to proceed more summarily to complete ablation of the mass by a stroke of the long amputating knife. To obviate

or diminish hæmorrhage during the section, the method usually adopted, is to suspend the tumour above the height of the body

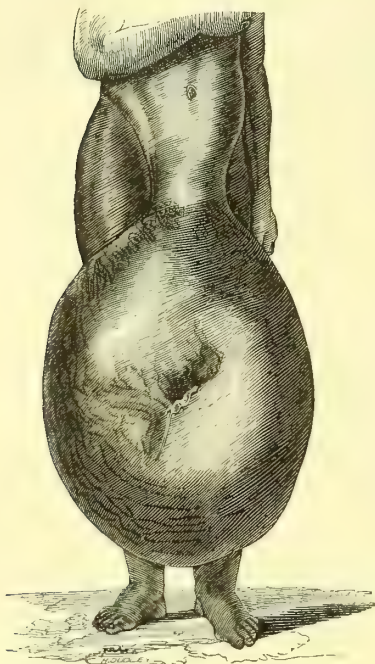


Fig. 47.

for some time before the operation, so as to empty the large veins, and then the direct control of the hemorrhage during the operation is best effected by the plan recommended by Professor Fayrer of Calcutta—namely, to carry a stout cord round the neck of the mass, and both ends having been passed through a strong steel ring, about the size of a small curtain ring, strangulation of the pedicle is effected by two assistants drawing on the ends of the cord in opposite directions. Or a large stout needle in a fixed handle, and blunt except at the point, and with an eye near the point of sufficient size to admit a strong

whip-cord, may be thrust through the narrowest part or neck of the tumour. The cord is thus carried through, the loop divided, and each half used to strangulate firmly one division of the neck of the growth, which is then cut off by the amputating knife. When the mass is removed, the open mouths of the vessels in the pedicle may either be secured separately, and the compressing cord removed, or if there be only slight oozing from the pedicle, the cords may be tied firmly and allowed to remain as ligatures. In cases where the tumour of the scrotum is of moderate size, and the integuments sufficiently soft to enable us to recognise the position of the testicle and penis; by careful dissection at the upper part of the swelling, we may clear and isolate these organs so as to save them and a portion of integument, but

even when the skin is so affected as to enable us to save but little, if any, it is wonderful how these organs become covered in by borrowing from the loose integuments of the abdomen and perineum.

Delpèche, in his *Clinique Chirurgicale*, has given the details of a case of elephantiasis of the scrotum in which, by planning his incisions, he obtained a covering for the parts at the time he removed the tumour; but in such prolonged and complicated dissections amongst hypertrophied and vascular tissues, the risk of the patient sinking from loss of blood is so great that it is better to take the more rapid methods of procedure. Before proceeding to the removal of the diseased mass, careful examination should be made to ascertain that there is no hernial protrusion on either side, as that condition has been found present, and if it be, the steps of the operation must be conducted with great care, and in some cases a large scrotal hernia might contra-indicate the operation.

The scrotal integuments are sometimes attacked by epithelial cancer. The parts present the usual appearances of that disease, and must be removed by the knife before the neighbouring lymphatic glands become affected. In operating, the integuments should be removed wide of the diseased part, and very little anxiety need be experienced as to there being sufficient covering left. In one case I removed almost the whole of the scrotal integuments, so that at the time it was impossible to cover in the testicles, yet in less than six weeks the wound was completely cicatrised without any apparent deformity; at all events, we must remove the disease thoroughly if we interfere at all.

There is a peculiar form of epithelial cancer of the scrotum in which the disease seems to arise from the effects of a direct local irritant. I allude to what is termed CHIMNEY-SWEEPER'S CANCER, or SOOT-WART. It is said by some that this is a peculiarly malignant form of disease, and it is quite true that if it be allowed to go on until the inguinal glands become affected and ulcerated, and till the ulceration extends

to the abdominal parietes, the local irritation soon destroys the patient. But from what I have seen of the disease, I believe that, like most canceroid affections arising distinctly from a local cause, if it be removed early there is not much tendency to recurrence, if the original exciting causes be guarded against; and I have seen enlarged glands disappear after the removal of the diseased integuments, showing that they had



Fig. 48.

merely been affected sympathetically. It is, however, quite possible that this affection may be excited in a person of cancerous diathesis, and then, of course, the progress of the case will be very different. The accompanying figure (No. 48), represents the disease in its latter stage, when the ulceration has destroyed the scrotum and exposed and affected the testicle.

Whatever difference of opinion may exist as to the extreme malignancy of the disease, there is none as to the treatment. Early and complete removal of the diseased part of the scrotum is clearly indicated.

When ulceration has taken place and extended, or is extending, towards the groin, the free application of chloride of zinc is the most efficacious remedy if the parts cannot be excised. For my own part, even in cases such as that represented in Fig. 48, I would advise excision of all the fungating margins and surrounding skin, and removal of the testes if affected, before applying the chloride of zinc, rather than trust to that remedy alone. I would do so even although there were enlarged glands in the groin; and from what I have seen I would not despair of success in arresting the ulceration, for I have great belief in the doctrine that canceroid disease, arising from a local cause, is seldom truly malignant as regards the constitution; and at all events, by such procedure as I advise, we can hardly make matters

worse, whilst we give a chance of relief, if not of absolute cure. When ulceration attacks the textures in the groin, we often find the common femoral artery and vein laid bare, and death may occur from hemorrhage caused by the ulceration of these vessels.

Epithelial cancer frequently attacks the prepuce, and may involve the glans penis and body of that organ, so as to necessitate amputation. The disease is very liable to arise in persons who are the subjects of congenital phymosis, as the lodgment of the sebaceous secretion between the prepuce and glans leads to attacks of irritation from time to time, and as the patients advance in life canceroid disease supervenes. If the disease is limited to the prepuce, free circumcision is all that is requisite ; but if the glans penis be affected, then the removal of the penis wide of the diseased part is imperative. In many cases the warty induration of the prepuce renders it difficult to ascertain the extent of the disease, and hence it is generally advisable to slit up the prepuce to make quite sure whether or no the glans penis be involved in the diseased action. Like canceroid affections of the lip and scrotum, there seems to be different degrees of malignancy in different cases. In some the disease appears to be entirely local, and shews no tendency to return, whilst in others it affects the lymphatic glands and the general system, and returns rapidly. I know of cases in which, more than twelve years ago, I removed the penis for canceroid disease of very unfavourable appearance ; at present the patients are in excellent health, and without the slightest tendency to recurrence of the affection, whilst in other cases I have known it recur in less than twelve months, and lead to cancerous tumours of the inguinal glands.

When removal of the diseased organ is obviously necessary, AMPUTATION OF THE PENIS is performed as follows :—The pubes and scrotum having been shaved, firm constriction of the penis is effected by a strip of cotton bandage tied in a slip knot, so as to command the circulation. The operator then grasps and stretches the penis, and, with a single stroke of a long amputating

knife, severs the organ well above the diseased part. He next looks for and secures the open mouths of the dorsal arteries of the penis, and the central artery of each half of the corpus cavernosum. The constricting bandage is then slackened, and two small vessels in the corpus spongiosum, on each side of and close to the section of the canal of the urethra, generally require to be tied, and also perhaps some small tegumentary twigs. The general oozing from the section of the corpus cavernosum, which is principally venous, is best arrested by the application of ice ; or, if necessary, a little of the infusion of matico or perchloride of iron. A soft vulcanised india-rubber catheter is then introduced into the bladder, and a circular piece of lint, soaked in carbolised oil, and perforated so as to pass over the catheter, is applied upon the cut surface of the penis. By this arrangement the urine is prevented from irritating the raw surface.

After forty-eight hours, or sooner, the catheter is withdrawn, and only occasionally introduced, to prevent closure of the urethra during the cicatrisation. Subsequently the patient should be furnished with a short straight metallic bougie to introduce from time to time, as there is always a tendency to contraction of the orifice, even for years after the wound has healed, unless preventive measures be taken.

THE DISEASES OF THE GENITO-URINARY ORGANS IN THE FEMALE have of late years had much attention bestowed upon them by obstetricians, and their treatment has in a great degree become a kind of special practice, forming what is termed Obstetric Surgery.

DISEASES OF THE OVARIES, in all that appertains to their diagnosis, and the earlier part of their treatment, belong properly to the domain of obstetric medicine, whilst the operation of ovariectomy belongs strictly to that of surgery. It will thus be evident to you that questions involving such breadth of detail and nicety of discrimination, can hardly be done full justice to in a course of instruction which only professes to deal with sur-

gery. We shall therefore limit our observations to that part of the subject with which every surgeon ought to be familiar, namely, the steps of the operation ; and refer you for fuller information regarding the whole subject to the works of Clay, Spencer, Wells, Keith, Bird, and others. It would be great injustice, however, to speak of ovariectomy, now an established operation, and to omit the name of John Bell, who first proposed it, or of John Lizars, who first boldly carried it into practice in this country, in the face of the almost unanimous opposition of the profession.

One or two major points of diagnosis will at once suggest themselves to you, and you would not be justified in proceeding to operate without satisfying yourselves with regard to them. Thus the site, size, definition, mobility, fluid or solid character of the tumour, and any tenderness, must be considered, together with the various phenomena discovered by careful auscultation, and superficial and deep percussion. These must be considered in the light afforded by the age, history, and habit of the patient, together with the progressive symptoms of the case.

Having satisfied yourself as to the propriety of operating, your next object must be to do so with the least possible risk to the patient. Due attention must therefore be paid to the hygienic surroundings as regards locality, air, light, cleanliness, and the arrangements for subsequent nursing. The operation consists in opening the abdomen, exposing the tumour, tapping the cyst or cysts, supporting the tumour so as not to strain the pedicle, securing the vessels by ligatures or clamp, finally removing what remains, and closing the external opening by sutures.

During the operation, the surrounding surface of the abdomen should be carefully protected from blood and other discharges which may issue from the wound, or from the surface of the cyst, during the necessary manipulations. This is best effected by spreading over the abdomen beforehand an apron of india-rubber sheeting, with an oval opening in the centre, made to correspond with the site of the proposed incision. The edges of the under surface of this opening are smeared with carbolic

adhesive plaster, by which they are closely attached to the skin. After the incisions have been made, and the superficial vessels secured, a piece of carbolised muslin, of a similar size, with a simple slit in the centre, is placed over the india-rubber, and over the part of the abdomen left unprotected by the centre opening in it. The edges of the muslin slit are then attached by acupressure needles to the edges of the wound, and the muslin spread out ready to receive the empty cyst. Thus the maximum of cleanliness and the minimum of exposure are attained, and ovariectomy is rendered one of the most delicate, as it is, in suitable cases, one of the simplest operations.

Having arranged your assistants—one to give chloroform, a second to apply pressure on the abdomen as the cyst is removed, a third to manage the trocar and tube and support the cyst—you should stand on the right side of the patient, and make an incision about four and a half inches in length over the *linea alba*, beginning two inches below the umbilicus, and extending towards the pubes. Make your way very carefully through the skin, fat, cellular tissue, and peritoneum, making use of a director for each successive step, and securing the smallest bleeding points as you proceed. Having reached the serous cavity, you use the finger for exploration, in order to ascertain the existence or non-existence of adhesions. These having been disposed of, you gently bring the cyst into view and proceed to tap it, by means of a trocar and long tube devised for the purpose. The cyst is then gently withdrawn from the abdomen, the pedicle secured by clamp or ligature, and cut through externally to either. Before closing the wound the opposite ovary should be carefully examined, and any rudimentary cyst either tapped or removed. Every bleeding point must be looked for and attended to. The sutures used for closing the wound must embrace the whole thickness of the cut structures including the peritoneum.

In cases where adhesions exist between the cyst and parietal peritoneum, or between it and any of the viscera, the operation becomes much more complicated, and great care is required in breaking up the adhesions or in separating them by the knife

and also in securing all bleeding points resulting from such dissection. The after-treatment must be conducted on the general principles already laid down in reference to great operations, but in ovarian cases a stricter antiphlogistic diet, and free use of ice or iced milk for nourishment and to allay vomiting, seems more indicated than in other cases.

Obstetric surgery also lays claim to the treatment of the various genito-urinary fistulæ. These are designated according to their site—VESICO-VAGINAL, and URETHRO-VAGINAL. They consist of chronic passages or perforations communicating between the cavities indicated through the substance of the intervening septum, and allowing the escape of urine, either in scanty tricklings or a steady stream, according to the size of the communicating aperture, and constituting one of the most distressing infirmities of humanity. Formerly the condition thus established was considered incurable, and we are indebted to Hendrick van Roonhuysen (1663) for the first feasible plan for its remedy. This was suggested by the operation for the cure of harelip, and consists of a similar procedure, namely, paring the edges of the fistula, and bringing the raw surfaces into close apposition. We shall content ourselves with an explanation of the steps of the operation.

Choose a bright day. Place the patient on her hands and knees, or recumbent on the left side. Insert a full-sized duck-bill speculum, of the form shown in the woodcut on next page, and expose the parts as fully as possible. Pare the edges freely, by catching up the lip of the fistula, and denuding the adjacent thickness by a sharp knife or scissors, so as to carry away the complete marginal ring, and leave, if possible, an elliptical opening. This leaves behind a large, wide, raw surface, for adhesion. Use torsion, and the application of turpentine for the bleeding points, and wait for the cessation of hæmorrhage. You next introduce metallic sutures by means of a tubular needle suitably curved, which is alternately inserted and withdrawn until a proper number of sutures are placed in readiness to be secured. You then tie them, one by one, and by this

means bring the denuded surfaces into close apposition and exact coaptation. Introduce a catheter, of the form shown, by the urethra, to favour cicatrisation and consolidation of the parts. Great care is required in the after-treatment. The bladder must be kept tolerably empty, by the use of the catheter,

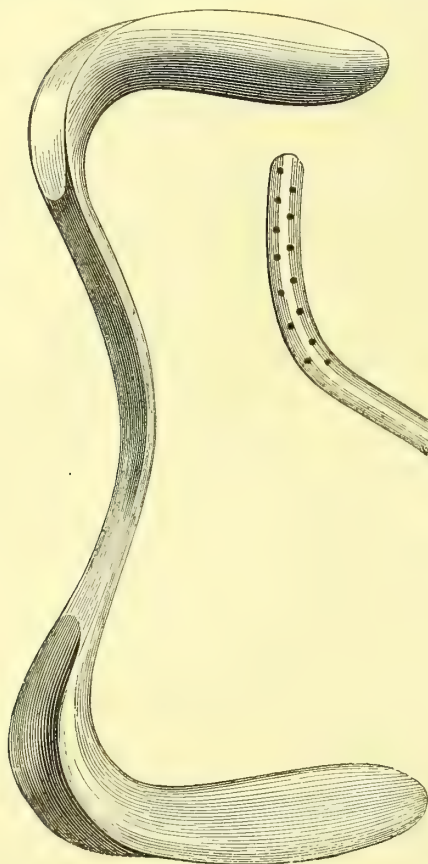


Fig. 49.

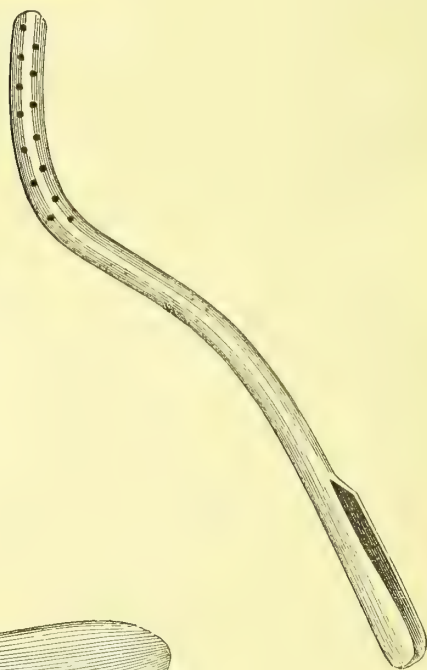


Fig. 50.

and the bowels at comparative rest by the administration of opium. After eight or ten days the sutures may be removed, and the bladder gradually allowed to distend, and at length to empty itself by its proper expulsive effort.

In some instances the wound may heal satisfactorily, and

then again give way. In one of my own cases, a very aggravated one, where the patient had been previously operated on, the wound healed firmly, and urine was retained; but some weeks afterwards, during a menstrual period, the wound again opened

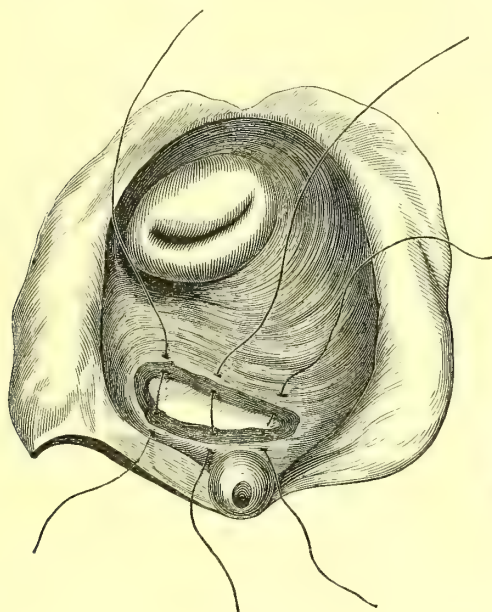


Fig. 51.

to a slight extent, and required to be touched with the heated wire.

Operative procedure is frequently required to repair laceration of the perineum into the rectum occurring during labour, or to remedy a relaxed condition of the vagina leading to prolapsus.

In many cases of lacerated perineum the injury is very limited, the sphincter and orifice of the rectum only being implicated; and in such cases, if the surgeon stitches up the part immediately after completion of the labour, such wounds often heal very readily, notwithstanding the apparently unfavourable condition of the presence of the lochial discharge. In cases where the rupture implicates the vagina and rectum higher up, the

operation consists in paring off the callous edges of the lacerated parts, after the patient has been properly prepared, and then uniting the margins by silver wire sutures, carried very deeply to keep the parts in close apposition. The operation for the relaxed condition of the vagina is performed as follows :—

The patient is placed recumbent, with the thighs separated, as in lithotomy. The large duck-bill speculum is introduced, its concave surface looking towards the posterior wall of the vagina. The operator then proceeds to make a v-shaped incision, the apex of the incision beginning about two or two and a half inches above the orifice of the vagina. The lines of incision as they descend should include the mucous membrane on the lateral wall of the vagina, as well as of the posterior wall, and also the perineal integuments at the orifice of the vagina. The triangular flap of mucous membrane marked out is then dissected off, so as to leave a raw surface. All bleeding points should be secured by torsion, or fine catgut ligature, and the parts washed by a stream of cold water from a syringe, and any oozing arrested by applying a little spirits of turpentine to the surface.

When all oozing has ceased, the surgeon takes a strong needle in a fixed handle, and entering it deeply, at least half an inch from the side of the vagina, carries it across the upper part of the raw surface, and brings out its point at the same distance from the vagina on the opposite side. A strong but fine soft silver or copper wire is then passed into the eye of the needle, which is withdrawn, so as to leave the suture, and this is repeated till three or four sutures are passed, so as to bring the perineal and vaginal wounds into accurate and close apposition. These sutures should be left in for at least eight or ten days, unless they give rise to irritation, and the vagina should be kept cleansed by gently syringing it out with weak carbolic lotion twice a-day.

In some of my earlier cases I used to employ the quilled suture, made with strong thread, to support the deeper parts of the wound ; and that method answers very well, and is still

preferred by some to the silver or copper wire. It is, in my opinion, of very great importance that the upper point of the vaginal wound be thoroughly secured, both that discharges may not enter and hinder union there, but also to prevent passive hæmorrhage taking place into the vagina when reaction occurs. To secure this, before tying the other sutures, I take a short curved hæmorrhoid needle, armed with fine silver wire or silk, and pass it across the apex of the incision at the highest point, and tie the ligature firmly. In one case, from neglecting this, I had considerable trouble from hæmorrhage into the vagina after reaction.

LECTURE CXXIX.

Diseases of the Rectum—Hæmorrhoids—External and Internal Piles : their Pathology : Constitutional Symptoms arising from Loss of Blood ; Treatment—Prolapsus Ani—Polypus of the Rectum—Anal Ulcers—Fissure of the Anus : Symptoms and Treatment—Anal Abscess—Fistula in Ano : Different Forms ; Treatment—Stricture of the Rectum : Simple and Malignant ; Treatment—Amussat's Operation for Artificial Anus—Imperforate Anus : Operations for that Condition.

THE DISEASES OF THE RECTUM, although comparatively few in number, lay claim to a large amount of attention, owing to their painfully distressing and often intractable nature. The functions of the parts render impossible anything like absolute repose, and the healing processes of nature are necessarily much interfered with. Such lesions, therefore, as might in other parts of the body heal without treatment, are by these causes protracted and aggravated, so that, instead of being ameliorated by time, their severity is generally in direct proportion to their duration.

Partly from an ill-founded hope of natural recovery, and partly from delicacy and fear, patients generally postpone consultation until increasing pain and declining health compel them. Our skill is therefore seldom brought to bear on the treatment of such diseases in their earlier stages, so that we must lay our account for dealing with them in their severer forms and complications.

Sometimes the anal orifice and lower part of the rectum are the seats of an aggregation of tumid, vascular, or cutaneous projections, purple or pale in colour, and moistened on the surface with a mucous or sanious discharge. These are termed HÆMORRHOIDS or piles.

Although the protruded mass presents these varieties in colour and character, it will be found on closer examination that

the cutaneous variety is placed on the outer side of the sphincter, while the purple and vascular hæmorrhoids arise from the inner side of that muscle. Thus, they are naturally classified into the two subdivisions of External and Internal. The former are generally dependent for their formation upon the pre-existence of the latter, and these, therefore, have the first claim upon our attention.

Internal piles originally consist essentially of a varicose condition of the hæmorrhoidal veins, arising from sedentary habits, constipation, pregnancy, or indeed any cause which retards the return of venous blood towards the heart, but more especially any affection of the liver or abdominal viscera obstructing the Portal circulation. Under such circumstances the hæmorrhoidal veins distend, and carry before them the loose mucous membrane at the lower part of the rectum, where they bulge out and form a tumour, in some cases almost like a prolapsus ani (Plate li. Fig. 4). As the disease progresses, the submucous tissue becomes thickened and altered in structure, the arteries supplying the mucous membrane become enlarged, and a separate and distinct growth is established, having special nutrient arteries. Still the disease remains dependent, in a great measure, on the venous dilatation, so that the pain and distension are relieved either by the bleeding of the pile itself or by the administration of such internal remedies as tend to relieve the congestion of the rectum. This congestion, however, will only be relieved by internal remedies to a certain extent, for the textures partake of their original hæmorrhoidal structure only to a limited degree. The remainder of the mass presents an altered condition of texture, nourished by a persistent vascular supply. Thus, we often find an artery ramifying upon the surface of an ulcerated pile, and the patient suffering from loss of arterial blood caused by ulceration of that surface. Hence the anæmia which often accompanies the disease, hence also the numerous cases of mistaken diagnosis, as the emaciation, palpitation, and dyspepsia, and other constitutional symptoms, closely resemble those arising from disease of the heart. In all cases, therefore, where these

symptoms co-exist with pain in the rectum, we should examine for piles, or for any abrasion or ulceration in the mucous surface; and generally, the experience or observation of the patient will materially assist us.

The *Treatment* of hæmorrhoids varies in different cases. When the piles are in the process of formation, and have not yet assumed the character of actual tumours, but of tumid sensitive points upon the mucous surface, nitric acid may be applied with benefit, especially for the flattened granular piles, whether recent or chronic. In order to do this, it is necessary first to empty the bowel, then to get it protruded by the efforts of the patient. The hæmorrhoidal surface being thus exposed, it should be touched with acid—the other portions of the bowel being at the same time protected by lard or oil. For the more advanced prominent hæmorrhoids the simplest, surest, and safest method of treatment is extirpation by the application of ligatures. For this purpose the bowels should be emptied as in the former case, and the piles made to protrude. They should then be seized one by one with a vulsellum, and each transfixed at its base by a needle armed with a strong double hempen ligature. The ligatures should then be separated, and each one tied very firmly, so as to constrict each half of the root. If these be efficiently applied, the tumours will separate in eight or ten days, and leave a granulating surface. The whole of the piles should be ligatured at one sitting, for if part of them only are so treated, the remainder will become congested and painful. The chances of enteritis, phlebitis, and other untoward results, are also much lessened by having the operation fully performed at once. Afterwards a full opiate should be given, and the bladder relieved from time to time if necessary.

With the view of obviating the injurious effects which are sometimes ascribed to the presence of ligatures, Mr. Henry Smith has introduced a mode of operation by which their use may be dispensed with. The hæmorrhoidal mass is grasped close to the root by a clamp, the blades of which are firmly screwed upon it. The strangled piles are then clipped off close to the clamp, and

the actual cautery, at red heat, applied to the remaining raw surface. This prevents hæmorrhage, and stimulates subsequent granulation. The outer portions of the clamp are shod with ivory, which, being a non-conductor of heat, prevents the adjoining parts of the rectum from being injured by it. The operation is said to be safe, cleanly, and effectual.

External Piles are placed, as already indicated, on the outer aspect of the sphincter, and are just the remains of what were internal piles situated near the verge. These become gradually protruded, and the mucous membrane assumes the cutaneous character after exposure for a time. They are mucocutaneous in character and consistency, pale in colour, and round or elongate in form. Sometimes they form a hardened or hypertrophied ring around the margin of the anus, the cutaneous rugæ of which are so far obliterated by their presence ; but more generally the skin near the anus hangs in loose folds.

As external piles are so far dependent for their existence upon the presence of internal piles, they should not be operated upon simultaneously with these, because, when the internal piles separate, the contraction of the mucous membrane may, and often does, cause effacement of the external piles and loose skin. Should this fail, however, recourse must be had to appropriate treatment, and this consists in simple excision. This is generally performed by means of probe-pointed curved scissors. The piles being superficial, any bleeding which may result can be arrested by ordinary means, and there is of course no fear of internal hæmorrhage, while that taking place externally is usually slight. The case might be otherwise, however, were this operation performed at the same time that ligatures are applied to the internal piles, for the congestion following that operation might then give rise to serious secondary hæmorrhage from the external raw surface. We should therefore first tie the internal ones, and then, some time afterwards, if necessary, cut off the external ones.

PROLAPSUS ANI is a term sometimes used to indicate two

different conditions, requiring very different treatment, and therefore I think it right to draw your attention specially to this subject. The one form, true PROLAPSUS OF THE RECTUM, consists of a projection of the whole thickness of a portion of the gut through the relaxed sphincter. The connections of the lower portion of the rectum prevent the whole thickness of that part being projected, and therefore in true prolapsus the projecting mass is formed by the loosely-connected upper part of the bowel invaginated within the lower or fixed portion; the relations of the different parts of the bowel being similar to that in intus-susception in the small intestine. This condition is very frequent in young and delicate, or even in otherwise healthy children, but is comparatively rare, though occasionally met with, in adults. The general appearance is the projection of a large ovoid or cylindrical florid mass, the everted mucous surface presenting, and on examination we can see and feel the continuous canal of the invaginated portion of bowel. Prolapsus usually takes place when the patient is straining, either at stool or during painful micturition, and it is a very common symptom in cases of stone in the bladder.

When the gut comes down, it generally soon attracts attention, and in the case of children the nurse or other attendant usually manages to reduce it under ordinary circumstances, and in adults the patient manages to do the same for himself by lying down and gently compressing and replacing the gut. In some cases, however, a very large cylindrical portion is protruded, and the reduction being more difficult, the surgeon is sent for. In such circumstances, if attempts have been previously made to reduce the protrusion, you should first apply cold to the parts, and, oiling the surface well, you should apply the pressure chiefly on the lower and central portion of the protrusion, so as gradually to invert and replace that, before you attempt reduction of the whole mass. The old orthodox and popular method of using the rounded end of a tallow candle is not altogether to be rejected, as undignified, as a means of applying pressure on

the central portion, but the fingers, properly used, generally suffice to effect reduction.

Reduction having been accomplished, the more difficult part of the treatment is to remedy the tendency to prolapsus, or to palliate that condition. In children all that is necessary is to regulate the bowels, and employ cold bathing, and other means for giving tone to the system, and of course to get rid of any source of local irritation which may be present as an exciting cause. In adults, especially those in advanced life, we often find that the tendency to prolapsus has been gradually increasing, and in such cases the integuments near the anus are generally relaxed, and form folds radiating from the margin of the anal orifice. When that condition is present, the treatment consists in clipping out the loose skin in longitudinal folds, including also a small fold of muco-cutaneous tissue covering the sphincter. In many cases this effects a permanent cure, if conjoined with appropriate general treatment. In other cases, however, any operation is contra-indicated, and then support must be given by a properly-adjusted prolapsus truss.

In neglected cases it may happen that, from congestion and swelling of the protruded portion of gut, it becomes strangulated, and then the condition is very dangerous, as, from the relation of parts, the whole canal is constricted. In such circumstances we should try to press aside the protrusion at one part, so as to get the edge of a probe-pointed bistoury applied to the sphincter, and effect its division, first at one and then at another point of its circumference, and then, having relieved this source of constriction, attempt reduction. But, as in intus-susception, it may happen that the constriction is higher up, and may have induced strangulation and gangrene, then the only chance of relief for the patient is to remove the mortified part by including each segment of the protruded gut in a double ligature, and then cutting them off. By doing this we at once remove the gangrenous portion, and expose and free the canal of the bowel higher up. This, however, should never be done unless the protrusion is gangrenous, and then the double deligation of each half of the

projected bowel must be carefully effected. To place a ligature around the whole protrusion, would be to tie in and obstruct the lower end of the intestine.

The other form of prolapsus ani consists merely of the swollen mucous membrane of the lower part of the gut protruded through the relaxed sphincter, as represented in Plate li. Fig. 4, and sometimes in even a large mass. It is really a hæmorrhoidal affection, totally different in its character from true prolapsus recti. There is no invagination, and the congested projections of the mucous membrane should be dealt with by ligature, as in any other form of internal hæmorrhoids. The removal of loose folds of the anal integument should subsequently be had recourse to.

Another diseased condition of the mucous membrane of the bowel, which is apt to be mistaken for hæmorrhoids, is POLYPUS OF THE RECTUM. The polypus consists of a pyriform pedunculated vascular mass springing from the mucous lining, and occupying more or less of the cavity of the bowel, whence it is generally ejected with every faecal evacuation. Its delicate structure is very ill adapted for such tear and wear, hence it often gives way, and this sometimes gives rise to considerable hæmorrhage. Independently of this contingency, such polypi are in themselves sufficiently troublesome, being sensitive in themselves, and sources of great irritation and severe lumbar pains and discomfort to the patient. They should be tied at the neck with a fine silk thread, and removed by scissors.

ULCERS OF THE RECTUM are not uncommon, and their presence is not only difficult of detection, but is often accompanied by most distressing and debilitating effects. The frequent passive hæmorrhage to which they give rise leads to great anæmia, palpitation of the heart, general emaciation and debility, whilst the comparative absence of local uneasiness may prevent us from suspecting the cause. Sometimes the hæmorrhage is active; and, on the part being protruded, or on using the speculum a small artery is found bleeding per saltum from the ulcerated surface.

A careful examination of the internal surface of the rectum, by means of the finger, may lead to their detection, but the surest method of diagnosis is to examine with the speculum. The forms of these instruments in general use are not well adapted for examination of the rectum. They are either fenestrated on one side, or have an oblique opening at the upper end. When the former are used, the loose mucous membrane projects into the cavity of the speculum, and the others—those partially open above—are still more objectionable, as they permit not only the mucous membrane but discharge from the bowel above to pass into the speculum. I have of late years devised a form which, if well made and carefully used, answers exceedingly well for examining the lower part of the bowel. It is made of glass, of the ordinary cylindrical form, perhaps a little longer and larger, closed at the top. One-half is coated and silverised in the usual manner, the other half is left clear; and the glass should be very equal, and free from waves or flaws. Before this speculum is introduced it should be immersed in warm water, to prevent its being dimmed by the heat or moisture of the bowel, and then when introduced, by gently turning it round, we obtain a very perfect view of the interior of the bowel. The only difficulty is caused by the folds formed by the laxity of the mucous surface, and that is best obviated by the size of the speculum tube. Were it possible to combine the clear glass side with an expanding metallic speculum, the instrument would be perfect for the purpose of diagnosis. The *Treatment* of anal ulcers consists in touching them with nitrate of silver or sulphate of copper. Ulcers of a more formidable character are sometimes associated with FISSURE OF THE ANUS, and, when not syphilitic, are amenable to the same treatment. This consists in transfixing the ulcer by passing a sharp bistoury through its hardened base and a portion of the sound texture beyond it. It is generally situated close to the internal extremity of the fissure, and is often continuous with it. After-treatment by lotions may sometimes be necessary.

FISSURE OF THE ANUS is the term used to denote a

crack or chap in the mucous membrane of the anal orifice, extending longitudinally in the direction of its rugæ, and lying concealed from view between them, or by a hæmorrhoidal projection. It can only be brought into view, therefore, by forcibly separating the nates, and then dilating the anus. This procedure, which can scarcely be effected except when the patient is under chloroform, will disclose a red irritable-looking crack, with hardened base and edges, which will be either dry, or moistened on the surface with a muco-sanguineous discharge.

The symptom attending the disease is an intense agony, which reaches its acme during and immediately after the act of defecation. The bowel feels as if it were dragged up, and sometimes the sphincter becomes spasmodically closed, so that the fæculent matter is retained, giving rise to symptoms like those of strangulated hernia, owing to the absolute constipation which often occurs.

Having made sure of the diagnosis, the *Treatment* is simple and effectual. All that is required is to take a narrow probe-pointed bistoury, lay the edge of this within the crack, and cut down through its hardened base. If the sphincter be much contracted, the incision should be extended through a few of its fibres; the muscle should be completely divided if the spasm has been intense. The operation may also be conducted by the transfixion method already indicated, by making use of a sharp-pointed narrow curved bistoury, and passing it under the dense base in the line of the fissure, bringing it out beyond its upper extremity, and cutting outwards. M. Ribes, who first drew attention to this operation, thought it was absolutely necessary to divide the whole sphincter, and in some cases it is certainly well to do so, in order to leave the parts at rest, but the essential part of the operation is to divide the hardened base. This is followed by immediate and entire relief of the patient. A coarser method has of late years been occasionally used, of introducing the operator's forefingers within the sphincter, and then forcibly tearing up the fissure; but it is a very coarse and uncertain procedure.

ABSCCESS IN THE VICINITY OF THE RECTUM was alluded to in the early part of the course, but it is necessary briefly to reconsider the subject here, owing to its connection with FISTULA IN ANO.

From some of the local causes of irritation which we have just been considering; from the presence of foreign bodies, such as portions of bone perforating the rectum and lodging in the tissues external to it; exfoliations from the pelvic bones; or, from a debilitated habit of body, inflammation may be set up in the neighbourhood of the rectum, and result in the formation of abscess in the ischio-rectal fossa. The pus, bounded below by the dense integument of the hip, by the ischio-rectal fascia, and levator ani internally, and the strong obturator fascia externally, makes its way towards the rectum at the inner and lower part of the space where the ischio-rectal fascia becomes thin and cellular immediately above the sphincter ani, and there it undermines, thins, and ultimately perforates the bowel; the abscess very generally opens also towards the integuments of the hip, and so gives rise to sinus or fistula.

After evacuation of the abscess, the openings formed, and the tracts or cavities connected with it do not heal, for mucus or thin fæculent matter or flatus from the gut passes into and keeps up the irritation, and these causes, together with the constant movements of the parts affected, prevent the healing process by contraction from taking place, and as a result we have the formation of Sinus or Fistula. The term is used to express that condition which we meet with in cases where the cavity of an evacuated abscess has failed to contract and heal, but where it remains open and continues to pour from its surfaces a thin unhealthy discharge of a gleety or muco-purulent character. Gradually the walls become thickened and callous, the cavity diminished in size, the lining surface smoothly glazed, like a mucous membrane, the discharge lessened in quantity and altered in quality. The action is sluggish, without tendency to heal, and thus the diseased condition becomes established. On introducing a probe at the opening, it is found to pass

inwards in a widening course, while here and there it may meet with projections, which render its progress irregular and tortuous. After a time these attempts at closure may become more numerous and continuous, until at length the original cavity, thus limited by them, may assume the character of a small hardened tubular canal. From the inner surface of this channel a thickened moisture exudes, and lymph is effused into the surrounding textures, so that the channel becomes more callous and persistent, having just sufficient vitality to prevent it from sloughing, but not enough to produce healing action. A fistula may be either straight or tortuous, generally the latter, and it may have either one or two openings. If it has only one opening, it is termed incomplete or blind: if it has two—the one opening internally, the other externally—it is termed a complete fistula. An incomplete fistula may have its opening either on the internal or external surface; in the former case it is more likely to become a complete fistula than in the latter, on account of the tendency of discharges to make their escape through the integument.

These fistulæ have little tendency to heal, although, after the opening or openings are formed, their cavities become considerably lessened, forming a simple elongated channel, the surfaces of which are constantly moistened by a thin gleetty discharge, which is alike pathognomonic of feebleness of action in the part and in the constitution. On introducing the probe by the external opening, its explorations are by no means restricted to such a narrow channel, for the efforts at closure have been weak and insufficient, and are easily broken down, so that the probe may possibly traverse the whole extent of the original cavity, and thus extend to beyond the internal opening, which seldom exists higher up than the distance of one inch from the orifice of the anus, for the anatomical reasons already stated. The external orifice of the sinus may exist anteriorly or posteriorly, in relation to the bowel, but it generally occurs at either side of it. The size is generally small, and it may be surrounded by pouting granulations, which form an elevated rim

or lip to the orifice. Into this opening the probe is passed, the forefinger of the left hand being at the same time inserted into the rectum. By means of the probe we ascertain the extent and direction of the sinus, and by means of the forefinger being gently opposed to it from within the bowel, we search for an opening, through which, if it exist, we can readily pass the probe. If there be no internal opening present, we ascertain the part of the bowel which has become most attenuated by the diseased action. Besides the fistula proper, there are often numerous sinuses passing in different directions towards the hip and perineum.

The *Treatment* will depend greatly upon the nature of the case. If you have been able to discover an internal opening, and have had great difficulty in finding it, you will do well not to withdraw the probe, but to retain it, and introduce a bistoury into the bowel, and cut out the probe. Thus, the intervening septum between the bowel and the cavity of the sinus will be laid freely open, and the diseased surface will gradually contract, granulate, and heal. If the internal opening be easily found, you may withdraw the probe, and introduce in its stead a probe-pointed curved bistoury; although I consider it advisable to bend and leave in the probe in all cases, to ensure complete division of the septum. The probe point of the bistoury is

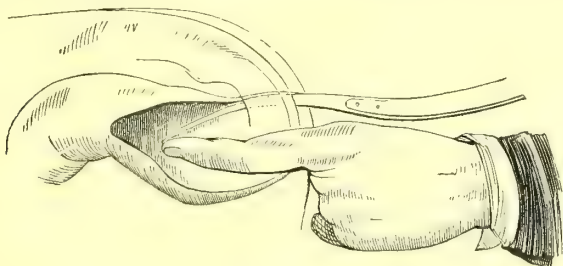


Fig. 52.

pressed against the point of the finger within the bowel, and both are withdrawn. Thus you will make a simple clean cut through the intervening textures constituting the septum, and leave the surfaces to granulate and heal. Should you fail to

discover an internal opening, you should select the thinnest, most attenuated part of the septum, and, forcing the bistoury through it, perform the same manoeuvre. In the case of an internal fistula, with no external opening, the internal opening is usually large and easily felt with the finger in the gut, and the integuments near the anus are boggy and undermined, so that, by making a small incision there, it is readily converted into a complete fistula, and dealt with as already described.

Sometimes, instead of using the knife, irritating injections have been employed with the view of causing obliteration of the sinus, and various other methods have been employed, sometimes with success. As a general rule, however, such endeavours serve only to lose time, and to waste the strength and resources of the patient. For the obtaining of direct and satisfactory results, nothing can equal the operation just recommended.

Previous to the operation the bowels should be thoroughly evacuated by means of an enema, and after the operation an opiate is given to prevent action of the bowels for a day or two.

Great care and cleanliness are required in the after-treatment. When the hæmorrhage, which is generally slight, has ceased, a piece of dry lint should be gently laid in, not stuffed into, the cavity. This serves to favour granulation, and to prevent the newly cut edges from reuniting and healing up. After this lint is removed I seldom introduce more dressing, but merely touch the surfaces lightly with nitrate of silver occasionally. This serves the purpose of slight stimulation, and simplifies the after-treatment, whilst pushing lint into the wound prevents the healing process, and induces undue action. Little else is required. The patient should be kept at rest in bed, and attention given to the general health.

From the frequency with which the disease under consideration is associated with disease of the lungs, no case can be said to be properly treated where the state of these organs is overlooked. If phthisis be far advanced, it would be obviously unwise to interfere locally for the relief of fistula; but where there exists only the predisposition, a good local result may be

obtained, and constitutional benefit may be derived from the cure of the fistula. Those remedies which tend to support and restore the general health must be employed, and change of climate recommended as soon as possible.

In the lower bowel we sometimes meet with a condition similar to that described in connection with the œsophagus, and constituting STRICTURE OF THE RECTUM. This arises at different points, generally either $2\frac{1}{2}$ inches above the sphincter, or at the upper part of the rectum, close to the promontory of the sacrum. It may be simple or malignant in character, and may vary in extent from a simple semilunar fold or puckering of the mucous membrane to a complete hardened ring, gradually narrowing

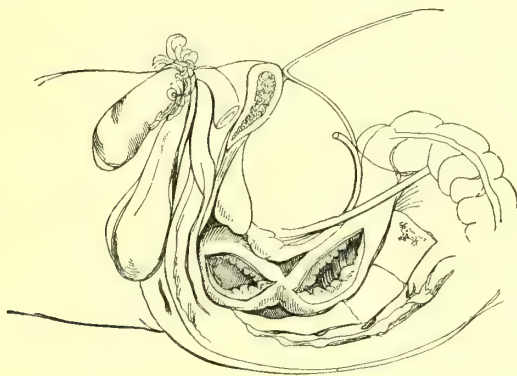


Fig. 53.

to occlusion ; or the contraction may arise from without, owing to inflammation and contraction of the peritoneal investment of the gut. This latter form is usually situated near the promontory of the sacrum. The rectum may also be spasmodically contracted at some point, and for the time being present all the symptoms of stricture. This last form can hardly be regarded as a stricture ; it is just a functional disturbance, created by the irritation of some other disease in the neighbourhood.

When stricture exists low down, its presence can be readily discovered by an examination with the finger. When it arises

at a part beyond the reach of the finger, the altered form and calibre of the fæces will guide us towards a diagnosis, and we will be further assisted by various constitutional symptoms. The additional work required by the bowel in forcing the fæces through the constricted part causes the portion immediately above the stricture to become greatly distended. This leads to general fulness of the abdomen, which becomes at length oppressive ; it also leads to vomiting, and various other reflex symptoms.

The constriction further leads to great irregularity of the bowels. Severe constipation, frequently alternating with equally severe diarrhœa, in which the semifluid contents, instead of coming away regularly, are expelled in violent and sudden gushes.

The irregular nodulated and indurated character of the circle of the contraction, and the peculiar sanious and foetid discharge which accompany the malignant disease of the bowels, taken in conjunction with the history of the case and the constitutional cachexy, will serve to distinguish the cancerous form of the disease from the simple stricture.

In the simple stricture we proceed by vital dilatation, on the same principle as in stricture of the œsophagus or urethra, by the introduction of graduated bougies, or sponge-tents, using opiate suppositories to allay irritation if excessive.

In malignant stricture, though we may require to use instruments occasionally in order to keep the gut pervious, still we can only look for palliation from such procedure. Sometimes the operation of opening the descending colon may be had recourse to, in this or in cases of simple stricture situated high up, but even this is only palliative, although better than passing bougies through an irritable cancerous rectum ; but in cancer the disease will prove fatal sooner or later.

In the rectum we are liable to meet with a form of stricture which we might diagnose to be malignant, while it is really not so. This is a syphilitic affection, ulceration of the canal leading to its contraction. It is accompanied with great irritation in the part, and the emission of a peculiar sanious and foetid dis-

charge. In addition to these local manifestations, we have the constitutional cachexy as in malignant disease ; but then we have the presence of other syphilitic lesions to guide our diagnosis, such as maculæ, enlarged glands in the neighbourhood of the groin, nodes, and very often a corresponding history. Appropriate constitutional treatment must be combined with local measures, and a favourable prognosis may be given. Hence we must be very cautious in our diagnosis.

THE OPERATION OF COLOTOMY, for the purpose of forming an artificial anus, is best performed by Amussat's method, which is accomplished in the following manner :—The patient being laid somewhat on his right side, the operator commences his incision immediately over the external margin of the mass of muscles forming the erector spinæ, and carries it transversely outwards and forwards for about three or four inches parallel to the crest of the ilium, nearly midway between the crest and the last rib, or rather nearer to the crest. On dividing the skin, fat, and fascia, the free margins of the latissimus dorsi and external oblique muscles are brought into view, with an interval between them. The cellular tissue is divided, the margins of the before-mentioned muscles held aside or partially divided. With a little further dissection the portion of the lumbar aponeurosis, giving common attachment to the internal oblique and transversalis muscles is exposed and carefully divided in the line of the external wound, and also notched upwards and downwards with the knife to give more room ; then, by gentle use of the knife and finger, the surgeon works his way cautiously, so as to expose the extra-peritoneal aspect of the descending colon. Where that intestine is distended with fæculent matter, it is easily enough recognised and opened, but when the operation is undertaken to palliate cancer of the rectum, this part of the colon is often contracted, and lies within the margin of the quadratus lumborum muscle, and the peritoneal sac is then in great danger of being wounded unless some caution be used. In opening the gut great care must be

taken to prevent fæculent matter escaping amongst the tissues ; with this object the surgeon should guard the parts as in ovariectomy, and introduce a wide india-rubber tube into the opening, and so allow the accumulated contents to escape gradually. He afterwards draws the opening in the bowel outwards, and stitches the mucous membrane to the integuments by continued suture, places a piece of oiled lint round the opening, and inclines the patient towards that side to favour the escape of the fæces. An opiate suppository should be placed in the rectum ; great attention paid to cleanliness, and the diet should be principally milk and farinaceous food for some days. A similar procedure will enable you to open the caput cœcum on the right side.

In proper cases, as in obstruction of the bowels from stricture of the rectum, or in cases of obstructed bowel, where the course of the colon can be traced distended with fæces, there can be no question as to the propriety of performing Amussat's operation. But in cases where the colon is not distended, or only distended by gaseous contents, as evidenced by percussion, and that distension only arising at a late period of the symptoms, then the probability is, that there is obstruction in the small intestine, and we must decide as to performing the more questionable operation of gastrotomy. The difficulties which may arise, both as to diagnosis and operative procedure, may be judged of by a case which occurred to me whilst writing these pages, and which will be found in the *Clinical Cases*, page 1420.

We have hitherto been considering the diseases to which the normal rectum is liable ; but I must now treat of an abnormal condition of it, in which the external opening, and sometimes the lower part of the rectum, are absent. This deficiency is termed IMPERFORATE ANUS. It is of course a congenital malformation. It is generally noticed at once by the medical attendant or nurse, but in some cases, where the rudimentary indentation of the anal orifice is deeply marked, it may

escape detection till the absence of evacuation of meconium attracts attention, and leads to the discovery of the malformation.

Sometimes the occlusion is quite superficial and membranous, so that the distended bowel causes it to bulge, and the dark colour of the contained meconium can be seen through the thinned integument. In other cases the rudimentary anus is separated from the termination of the bowel by the thickness of an inch or more of intervening cellular tissue, and not unfrequently the bowel is found to communicate with the vagina in the female, or the urinary bladder, or more usually the urethra, in the male.

In some instances no trace of the anal depression is to be seen, and this indicates that the malformation is in an extreme form, and that the cul-de-sac of the gut is placed high up in the pelvis. In many cases of imperforate anus other congenital malformations exist, and the most frequent is imperfect development of the kidneys. In one infant on whom I operated, where the gut terminated high up, the child lived for three days, and died with well-marked symptoms of uræmia, scarcely a table-spoonful of urine being secreted during its short lifetime. The whole interior of the bladder was studded with dark nodulated masses like effused and hardened blood, and there was scarcely any trace of the kidneys, except a cyst attached to the ureters. In other cases I have seen similar conditions.

In regard to the *Operation for Imperforate Anus*, that will be modified by the nature and extent of the malformation. In the simpler forms all we require to do is to take advantage of the swelling of the distended bowel when the infant is crying, and to make first a longitudinal and then a transverse incision, and introduce the tip of the little finger and dilate it, and nature will keep the orifice open. When the rectum terminates high up, we must proceed more carefully and methodically. We must keep in mind the small size of the pelvis, and the relations of the bladder and internal iliac vessels. The bladder should be emptied by a catheter, to diminish the risk of its projection being mistaken for the cul-de-sac of the rectum; because, when the lower part of the gut

is absent the bladder falls downwards and backwards into the pelvis. This precaution having been taken, the operator should incise the integument exactly in the position of the anal depression. The point of the narrow bistoury should be inserted at the anterior part of the depression, with its edge directed towards the coccyx, and carried back to beyond the posterior margin of the depression, then a transverse cut is made on each side, so as to make a crucial incision and give room to introduce the finger. In those cases where no trace of the anal depression exists, the surgeon must judge of its position by the relation of the tuberosities of the ischium and other parts of the perineum. The first incision should be carried deeply through the textures, so as to open into the lower part of the pelvic outlet, and the finger is then introduced along the hollow surface of the sacrum, the point directed very slightly upwards, but never forwards, for the lower cul-de-sac of the peritoneum with the contained viscera might be wounded. In general the cul-de-sac of the bowel can be felt when the child cries, or when the abdomen is pressed upon by the assistant. By passing the narrow bistoury or a flat trocar and canula upwards in the direction indicated, the bowel is punctured and some meconium escapes. A probe-pointed bistoury is then introduced into the aperture so made, to enlarge it, and allow of the free escape of the meconium, and subsequently of the fæces. Figure 3 in Plate lvii. gives a plan of the operation, and shows the relation of the contracted bladder and peritoneal sac to the pelvic cavity and cul-de-sac of the imperfect rectum, but it is very rare indeed that the finger can be introduced as there represented to guide the knife; the space is too small. We must feel for the gut with the finger, and then withdraw it, and guide the knife by the information so received. In some cases I have managed to introduce a tenotomy knife over the finger to open the bowel.

When the opening is enlarged, if the cul-de-sac be placed very high, we should try by gentle pressure and traction to bring it down nearer to the surface, otherwise there is risk of effusion of fæculent matter lodging in the hollow of the pelvis and lead-

ing to fatal consequences. In all such cases it is necessary to maintain the orifice patent, and to prevent contraction during the healing process. A portion of gum elastic, or wax bougie, is generally used for this purpose, or a portion of sponge tent. The sponge tent is useful after a time, but too irritating at first. The substance I have found to answer best immediately after the operation, is a conical suppository composed of beeswax and soap. Afterwards a large bougie or a sponge tent should be introduced occasionally to prevent contraction.

The tendency to contraction continues for a long time—for years indeed. In one case in which I had operated I was consulted by the patient when he was about twenty years of age on account of the inconvenience caused by the contraction of the orifice. I found it would hardly admit a No. 9 urethral bougie, yet he was in perfect health. I enlarged the orifice freely by a crucial incision, and advised him as to the occasional use of the rectum bougie, and as I have heard nothing of him for many years, I presume the contraction has not recurred. One peculiar anatomical fact in regard to imperforate anus is, that in the worst form, even when there is no anal depression, it has been found on dissection that the fibres of the superficial sphincter can be distinctly traced under the skin.

In cases where the cul-de-sac cannot be reached, it has been proposed to open the descending colon in the left lumbar, or the sigmoid flexure of the colon in the left iliac region, and successful cases are recorded, but in general we could hardly expect, or even I may say desire, such a success in an infant.

CLINICAL CASES

ILLUSTRATIVE OF THE TREATMENT OF HERNIA.



CASE I.—SCROTAL HERNIA. PECULIARITY IN THE CONSTRICTION.

P. B., aged 40, the subject of the present case, had been affected with hernia for a great many years. At an early period of the complaint he had worn a truss, but for some time back had discontinued its use. Since then, the swelling had rapidly increased in bulk, but he had always been able to reduce it himself when it became troublesome.

On the 25th of August 1840, he was attacked with vomiting and twisting pains in the belly, which, as he had been living rather freely for a few days previously, he attributed to an "attack of bile," and did not apply for medical assistance until the morning of the 27th, when the hernial swelling became painful, and on trying to reduce it as usual, he found he could not do so. He then sent for Mr. Lawrie, who tried to reduce it by taxis, but without success. I saw him for the first time, at 9 P.M. of the 27th August, along with Mr. Lawrie, when his state, as recorded in my notes, was as follows :—

"There is a large scrotal hernia on the right side, which is tense, and painful to the touch ; but the contents of which can be returned into the abdomen, with the exception of a hard rounded mass, which feels exactly like an enlarged testicle, and which cannot be reduced. The cord can be felt behind the hernia, and the testicle, of natural size, in its usual position, at the lower part of the scrotum. He has frequent vomiting and hiccup ; the belly is tense, tympanitic, and tender to the touch, and he complains of severe twisting pains from the hernia towards the navel. Except a scanty stool when the vomiting first began, he has had no motion in his bowels since the commencement of the attack, although enemata and laxative medicines have been given. The expression of his countenance is anxious ; skin rather warm, and covered with perspiration ; pulse 108. He says that he never felt the 'hard lump' in the rupture on any previous occasion."

At half-past 11 A.M. I saw him, along with Drs. J. A. Robertson, J. Reid, and Duncan. The symptoms had become more urgent, and there was constant hiccup. Cold having been applied to the tumour, and the taxis again fairly tried, but unsuccessfully, I proceeded to operate. An incision about three inches long was made over the swelling, commencing at the situation of the deep ring, and continued downwards ; the different coverings were then divided, and the sac exposed and opened, in the usual manner, to a sufficient extent to enable me to pass my finger upwards to

the ring. Having divided some sharp resisting fibres at that point, I next proceeded to reduce the contents of the sac ; but after reducing some convolutions of the gut, I found that the intestine seemed to be firmly fixed below ; and on opening the hernial sac, a little farther down, I exposed a rounded fleshy-looking mass, evidently adherent to the scrotum by its outer surface. Its appearance was singular, resembling somewhat a portion of the large intestine twisted round the lower part of the loop of the small intestine, which had been partially reduced, and some of those present thought it was an intus-susception of the bowel contained in the hernial sac. As, however, it was evident that its circumference strangulated the other portion of bowel, it was resolved to notch its edges slightly with the bistoury, at different parts, so as to try and relieve the bowel embraced by it. So tight was the constriction, that I could not introduce the probe-pointed bistoury between its edge and the intestine, and was obliged at first to divide from without inwards. When the stricture was thus relieved, the true nature of the case was at once seen—viz. that the fleshy-looking substance surrounding and strangulating the intestine was a small subdivision of the lower part of the sac, greatly thickened, altered in structure and appearance, separated from the upper portion of the sac by a firm, narrow neck, and closely adherent to the scrotum below. The bowels were then reduced, a compress and bandage applied over the wound, and a large opiate draught directed to be given immediately.

I saw him again at 3 P.M., and found that he had had no return of the vomiting or hiccup ; the bowels had not yet acted, but the enema had just been given before I called. His pulse had fallen to 96, and he expressed himself as much relieved.

At 8 P.M. his pulse had fallen to 86, and was soft ; he had had one evacuation after the enema ; he said he felt much better, complained of no pain on pressing the abdomen, except in the immediate neighbourhood of the wound. I directed him to take half-an-ounce of castor oil, to obtain a free motion from the bowels, and to have another opiate at night. I offered to send a person to watch him, but his friends stated that they had procured one of his own relations, a sick-nurse, for that purpose, whom he would prefer to a stranger. I left strict orders to keep him perfectly quiet, and to let me know at once should any unfavourable symptoms appear.

I heard nothing further till next morning, when, on my way to visit him, I met a person coming for me, who said he had not been quite so well during the night ; and on entering his room, to my surprise I found him moribund, and no one in the room with him. From his landlady I then learnt that no sick-nurse had ever been in attendance, and that his brother and some acquaintances had sat up with him ; that they had given him, at his own request, a quantity of porridge and beer, shortly after which the vomiting had recommenced, with pain in the belly ; and these symptoms had been allowed to go on without ever sending for me or Mr. Lawrie.

Every effort was made to procure a *post-mortem* examination of the body, but without success.

COMMENTARY.—The points principally worthy of remark in the case are—1st, The unusual position of the seat of the stricture, viz. in the body of the

sac, and towards the lower part of the scrotum, and the peculiar appearance of the lower part of the sac, as seen during the operation ; 2d, Some symptoms and features of the case, which, taken in conjunction with the patient's previous history, may serve as guides in the diagnosis of similar cases, and may also lead us to modify our operative procedure in such cases.

With regard to the position of the constriction, it may be said, that, though rare, it has been noticed by several writers on hernia. Scarpa gives a plate of a hernia, with constriction of the sac in the scrotum, and points out the double swelling as marking the nature of the case. Lawrence mentions the case of a young man on whom he operated, in whom there was a very tight stricture midway between the testis and external ring, and where he had great difficulty in distinguishing the true nature of the lower swelling, the upper part of the sac having been opened first. Pott, Wrisberg, and Pelletau, all mention having met with similar cases ; but these differ from that which I have just detailed, inasmuch as they were all cases of congenital hernia, and the constriction in the middle of the sac was caused by the contraction marking the natural division of the tunica vaginalis from the general peritoneal sac. I consider this an important difference in a practical point of view, because in these cases, although the sac would be constricted in an unusual position, and therefore render the nature of the case sufficiently puzzling, still the lower part would be of the same appearance as the upper portion, they would both present the usual appearance of serous membrane, and thus the continuity of the upper and lower portions would be more readily recognised. Whereas, in the case I have described, the causes which had given rise to the constriction in the sac had also effected alteration of structure in that part of it below the stricture, and thus gave rise to greater embarrassment in the operation. What these causes were, and how they had acted in producing these effects, are, I think, obvious from the history of the case. The man, when first affected with a small inguinal hernia, had worn a truss, and continued its use for many years. The effect which this would have by its continued pressure in causing constriction of the neck of the small sac, where it lay opposite the external ring, and also in condensing and altering the structure of its whole surface generally, will, I think, be readily admitted. After a time, the use of the truss was discontinued, and the result was, that a larger hernial protrusion took place, not entering into the original sac, owing to the narrowness of its opening at the contracted neck, but carrying along with it a fresh portion of peritoneum, and pushing the small sac down before it into the scrotum. So long as matters remained in this state, the patient could always reduce it himself ; but on this one unfortunate occasion, a part of the bowel had passed through the contracted part into the lower division of the sac (or into what was the sac of the original small hernia). This was the state of parts when the operation was performed. The upper part of the sac was opened, and part of the intestines returned, when a small tumour was brought into view closely connected with the scrotum ; and now came the embarrassment, for there was no appearance of continuity between this and the superior part of the sac, owing to the tightness of the contraction ; it was also totally different in appearance, and to the touch. Here, I think, it will be allowed that this was much more embarrassing than the cases of congenital hernia, where the lower part, or

tunica vaginalis, unaltered in structure, would be more easily recognised, and where, from the relative position of the testicle, further assistance in diagnosis might be gained. Indeed, I confess, that the only thing which decided my action in this case, was the practical consideration, that whatever the thick fleshy substance surrounding the intestine might be, it was evidently strangulating it, and therefore equally evident that its constricting edges must be divided to relieve the strangulation.

We now consider those points in the case which may assist us in our diagnosis, and regulate our operative measures in similar cases. The diagnostic marks of most value, were those derived from examination of the swelling, and the feeling of it when trying to reduce it by taxis; for, although it presented at first sight the usual uniform appearance of a large scrotal hernia, yet a small "hard lump" could be felt at its lower part, distinct from the rest, and on attempting reduction, all the contents of the sac could be returned, except this "lump," which the patient, who had hitherto been in the habit of reducing the swelling himself, at once stated he had never felt there before. Attention to these points, connecting them with the history of the case already mentioned under the former head, when speaking of the position and peculiarities of the stricture on the sac, would I think lead the surgeon to discover the true character of the case, before proceeding to operate; and then the question arises, How should such knowledge modify our plan of operation? Should we cut down upon the small swelling at the lower part of the scrotum, divide the constricted part of the sac, and reduce the bowel, without interfering with the upper division of the sac at all? I do not think this would be a very judicious plan; for, in the first place, the lower part of the scrotum is not the most favourable place for incisions; and, further, we may have obstacles to the reduction of the hernia situated higher up, and if we require to divide them also, then our incision would extend through nearly the whole length of the scrotum, up to the inguinal ring, a thing always to be avoided. I should, for my own part, if I altered my mode at all, in a similar case, reduce as much as possible of the hernia, before proceeding to the operation, and this would bring the irreducible portion, or smaller division of the sac, up towards the inguinal region and upper part of the scrotum, and then the incisions might be made in the usual manner; only we must recollect that the contents of the larger or superior division of the sac having been reduced, the smaller or lower portion would necessarily become invaginated within it, so that more than one layer of serous membrane would be divided before the strangulated intestine would be exposed.

CASE II.—SCROTAL HERNIA, APPARENTLY REDUCED BY TAXIS. SMALL HERNIAL TUMOUR FELT AT UPPER PART OF CANAL; OPERATION; DEATH.

Mr. C., æt. 85, was seized with the symptoms of strangulated hernia on the 23d December 1853. He was seen by Dr. Cruickshank of North Berwick, who found a large scrotal hernia which the patient stated he had had for upwards of twenty years, but that it had never troubled him, as he could always reduce it. Dr. C. returned the tumour apparently by the

taxis, but the symptoms still continuing, he asked me to meet him to examine the case. I visited the patient on the afternoon of the 27th, and found him restless and suffering from hiccough. I was informed that the vomiting had not been so bad for some hours, and that he had had a slight motion of the bowels after an enema. The abdomen was tense and painful to the touch; there was, however, no distinct appearance of hernial swelling, but merely a general fulness from great development of fat on both inguinal regions. On examining the left side where the large scrotal hernia had existed, by passing my finger from below upwards along the cord, I thought I could detect a small swelling at the upper part of the canal. After again examining him, and feeling more satisfied as to the existence of the small swelling, I explained to his friends the necessity of an operation to afford him the only chance of relief, although, from his exhausted state and advanced age, the case was very unfavourable.

He had previously suffered from acute rheumatism and asthma, and on trying to administer chloroform it so depressed his pulse that its use could not be continued.

An incision was made, beginning well over the position of the deep ring and carried down for about $2\frac{1}{2}$ or 3 inches. A very great depth of fat required to be divided in order to reach the tendon of the external oblique. I then slit up the tendon from the external ring so as to expose the canal, and when this was done I brought into view a small hernial tumour, about the size of a walnut, constricted at the deep ring. The sac was cautiously opened as there was no fluid in it. The bowel was found very red and granular, but not very dark, and it presented no appearance of gangrene. The constriction was then divided directly upwards. I next gently drew down the gut to examine it immediately above the stricture, when I found a small firm band of lymph constricting it within the sac. This I also divided, then readily returned the bowel, and dressed and bandaged the wound in the usual manner.

I did not see the patient again, but I learned from Dr. Cruickshank that after a temporary relief, the symptoms of vomiting and hiccough returned with abdominal tenderness, and the patient gradually sank and died on the 30th of December.

Remarks.—In this case, the doubt as to the existence of any portion of hernia being down, together with a deceptive remission of the symptoms, rendered it much more difficult to decide as to operating. The hernia, originally a large scrotal one, had been reduced by Dr. Cruickshank, with a distinct gurgling sound, of which the patient was sensible. There was also for a day some remission of the symptoms, and a slight stool. These circumstances, taken in conjunction with the absence of any apparent swelling in the inguinal region, when compared with that of the opposite side, or by examining the surface of the abdomen with the fingers, seemed to prove that the hernia had

been reduced, and from its large size, it could not have been reduced "en bloc." On the other hand, though there had been some remission of vomiting, still there was not that relief which follows complete reduction by taxis. There were the quick pulse, hiccup, clammy sweats, abdominal tenderness, tympanitis, and occasional vomiting on taking liquids; and the mere remission of the vomiting is by no means uncommon in cases of strangulated hernia. The most deceptive symptom to my view was the character of the stool; it was scanty but liquid and bilious-looking, as if from the upper part of the intestinal canal; and this, in conjunction with the statement that several distending enemata had been given, which came away without any *fæculent* matter, whilst the thin stool had been passed after the patient had taken some medicine by the mouth, I confess somewhat staggered my decision at first, but after several careful examinations of the dilated inguinal canal by my finger introduced along the cord, I was sure I felt a small swelling very deep, and too tense to be merely a part of the sac, and therefore, after explaining the necessity of giving the patient a chance of relief, I operated, and as it proved, the state of matters justified my decision. In a younger person, there would have been less room for hesitation, because in such a case the mere incision, even supposing no hernia had been found, would not have been dangerous.

Besides the difficulties of diagnosis, there is another point of interest in Mr. C——'s case, the peculiar cause of strangulation of the small knuckle of bowel. When the great mass of the hernial contents was reduced by taxis, what prevented the return of this small portion? Before operating, I thought it might depend on a double constriction in the sac, similar to that in the preceding case of P—— B——. But on opening the sac, the true cause was explained by the presence of a band of lymph constricting the loop of bowel—in fact, an internal strangulation within the hernial sac, keeping the constricted portion distended, leading to its further strangulation by the neck of the sac at the deep ring, and so preventing reduction. The occurrence of such cases has sometimes been argued against the extra-peritoneal

operation for hernia, as it has been said that we cannot be certain in any case that such an internal constriction may not be present. But if we pay attention to the rule to make sure of being able to return the contents of the sac without forcible pressure, and take care not to push the sac and its contents back *en masse*, we may feel satisfied there is no such constriction. For although in this case not only all constriction external to the sac was divided, but even the neck of the sac itself, the knuckle of bowel still remained tense, and could only have been reduced by forcible pressure, if at all, and therefore I believe that the objection is groundless, inasmuch as division of the textures external to the sac would not permit of reduction, and thus the surgeon would be necessitated to open the sac, and so recognise the true nature of the case.

CASE III.—FEMORAL HERNIA. IRREGULAR OBTURATOR ARTERY
CONSTRICTING THE INTESTINE.

In the history of this case I have purposely been most particular in detailing minutely every point connected with the operation, so that the practice resorted to, the reasons for its adoption, and the remarks which follow, may be perfectly understood.

Archibald H—, æt. 49, the subject of the present communication, had been under treatment in the medical wards of the Infirmary for some time, on account of severe chronic bronchitis, and skin-disease. He had suffered from femoral hernia for many years, which he had always hitherto been able to reduce by taxis, although often with considerable difficulty. On the evening of the 17th of March, I was requested by the resident physician to see the patient, as the hernia had come down suddenly about six hours previously, during a fit of coughing, was of larger size than usual, and had resisted the efforts made to reduce it, whilst vomiting, together with pain and tension in the swelling, had supervened. The resident physician informed me that he had tried the taxis as on former occasions, and that failing, it had also been fully tried whilst the patient was under chloroform by one of the resident surgeons, but without success; I learnt, moreover, that the patient had been making constant but unavailing efforts to reduce it himself. I found him vomiting, complaining of pain in the abdomen, and with an anxious expression of countenance. The hernia, which was a femoral one, about the size of a large orange, was tense, and painful on pressure. I had him put under the influence of chloroform, and judging from the state of the

swelling and the previous efforts for reduction, that it would be better not to persist too much in the taxis, merely made a slight trial, and failing in that, proceeded to operate. I divided the integuments over the hernia, as I usually do, by a τ incision, but owing to the depth of the fat, and the bulk of the tumour, converted it into a crucial incision to gain more room. The superficial fascia having been divided so as to expose the tumour, it was seen to be of a somewhat irregular form on the surface. On drawing the body of the swelling downwards, the falciform edge was seen, with the neck of the hernia very deeply situated. The fasciæ immediately covering the sac were next cautiously cut through, and a small flat director was insinuated beneath the margin of the falciform edge, which was notched with the bistoury sufficiently to enable me to use the point of my finger to guide the knife in dividing the deeper constriction. On pressing my finger upwards, I became sensible of the indistinct pulsation of a vessel close to the constriction, and, therefore, only made a very slight notch upwards and inwards, and another directly upwards, so as to divide the stricture at two points of its circumference. This enabled me to get the point of my finger so far below the crural arch as to push the vessel upwards and divide the arch to a sufficient extent to allow of the reduction of an ordinary hernia. I then scratched through a few fibres lying immediately on the neck of the sac, and attempted reduction without opening it, but unsuccessfully. I made the less effort to do this, as the hernial contents, as seen through the thin sac, seemed exceedingly dark and tense. I therefore opened the sac, and gave vent to a quantity of dark bloody serum, and exposed a portion of intestine (the cæcum), tense, and almost black from ecchymosis. Anxious to avoid, as far as possible, any further pressure on the bowel, I again enlarged the division of the ring sufficiently to enable me to introduce my finger, and also to draw down and examine the portion of intestine immediately above the stricture: I now found the contents of the sac to consist of the cæcum and the lower portion of the ileum; the latter was at once easily reduced, but the cæcum, from its form and connections, could not be so readily returned, and as, on examining it, I found a small portion of its peritoneal and muscular coats had been lacerated by the attempts at taxis, I thought it safest to make a still freer opening by dividing Poupart's ligament completely. With this view the cord was drawn upwards with a blunt hook, and I carefully dissected through the lower part of the tendon of the external oblique in a line corresponding to the centre of the femoral ring. Having fairly divided the superimposed textures, I found that there was still some constriction higher up preventing the gut being returned, and which kept it tense. On passing my finger up, I felt a tight cord-like substance encircling the hernia external to the sac, and recollecting the vessel I had felt pulsating, I at once concluded this must be the irregular obturator, whilst from the bulk, distension and state of the protruded gut, it was equally evident this constricting cord must be divided to permit safe reduction. Accordingly, keeping the finger of my left hand within the sac, as a guide to the constricting vessel, I used the forefinger of my right hand so as hook it down, and brought it distinctly into view. The vessel was tied with two ligatures, and divided between them, the gut reduced, and the wound dressed and bandaged in the usual way.

I ordered an opiate to be given, and directed leeches to be applied at

once, in case any symptoms of peritonitis supervened. Next day the pulse had risen to 120, and there was pain in the abdomen, and vomiting. Fifteen leeches were applied, and a pill, composed of 2 grs. of calomel and $\frac{1}{2}$ gr. of opium, was given every four hours. On the 20th, the abdominal tenderness and the vomiting were less, but as the bowels had not yet been moved, an assafoetida enema was administered, this produced no satisfactory evacuations; a large distending enema on the 21st also failed to open the bowels, a dose of castor oil was therefore given on the evening of the 22d, and, on the morning of the 23d, after another large enema of warm water, a very considerable fæculent evacuation took place, with great relief. On the 24th his general appearance was better, the pulse had fallen to 100, and the abdominal tenderness now complained of was confined to the lower part of the abdomen, and evidently due to inflammation, and threatened suppuration in the abdominal parietes. He could retain food without vomiting, and was ordered chicken soup and some port wine. He was weaker and restless on the 26th. There was considerable pain and tension at one part of the abdominal parietes, and it was thought advisable to make an incision, in case of purulent matter being confined; but the incision, though carried deeply, did not open any purulent collection. A poultice was directed to be applied. The patient continued much the same till towards the morning of the 27th, when he became worse, sank rather suddenly, and died at 11 A.M.

Post-mortem Examination.—On opening the abdomen, there were found the marks of acute peritonitis, but in a great measure limited to the right iliac and pelvic regions; lymph was effused upon the surface of the intestines, and there was a small quantity of turbid serum in the pelvis. The cæcum had regained nearly its normal position and appearance, retaining only slight traces of ecchymosis; the abraded part of its peritoneal and muscular coats, however, was as distinct as when first seen during the operation, and no attempts at plastic reparation seemed to have taken place; the lower parts of the ileum were also free, except a portion about three inches in length, which was thickened, and adherent to the parietal peritoneum in the neighbourhood of the wound.

Before making any further dissection, I inserted a pipe into the right common iliac artery, and threw in some injection to distend the vessels, so as to be able to examine them more carefully afterwards.

On examining the swollen parts of the abdominal parietes, the muscular tissue was found generally thickened, and of a dense brawn-like consistence; whilst the substance of the rectus and oblique muscles was studded with numerous small collections of pus of a dirty grey colour, and which seemed infiltrated into their texture, not escaping readily when the collections were opened. There was also a considerable diffuse abscess in the sub-peritoneal cellular tissue on the right side of the bladder, at some distance from the wound. The parts more immediately concerned in the operation were removed for further examination.

On careful dissection, I found, as might have been expected from the lapse of time, that the parts were considerably matted by plastic effusion. On dissecting from without, I found the whole of the falciform process, together with the lower border of the tendon of the external oblique, fairly divided, and the spermatic cord and its investments laid bare, leaving,

Fig. 1





even after the contraction consequent on the healing process, a very free opening.

Dissecting from within, I found the epigastric artery of a large size, and the obturator arising from it; this latter vessel was obliterated to some extent, and diminished in size, from the effects of the ligature. The ligature on its proximal end had not separated, that on the distal end had; but the injection had entered the distal portion by the anastomosing vessels, so that the course of the artery round the opening through which the hernia passed, can be readily traced in the preparation; a sketch of which is subjoined (see Plate lviii.) It arises from the epigastric before that vessel has ascended on the parietes, creeps slightly upwards on the outer side of the femoral ring, then curves closely around its upper border, and finally descends along its inner side to gain the obturator foramen, so as to encircle the opening at all points available for division with the knife.

I learn from Mr. Edwards, one of the demonstrators in the University, that the artery was also irregular on the opposite side,—where the epigastric arose from the common femoral, passed upwards in front of the femoral vein, and, on reaching the abdominal parietes, gave off the obturator so as to surround the upper part of the crural ring; unfortunately, however, the dissection has not been preserved.

Remarks.—This case is, I believe, unique in one respect, being, as far as I can learn, the only one in which the presence of the artery has been ascertained during the operation, and avoided in incising the ordinary seat of constriction; whilst its ligature and division were ultimately necessitated, from the vessel itself being the obstacle to reduction.

But I think it principally worthy of being detailed, as it seems to me to show practically, that, in cases of femoral hernia, where the irregular vessel exists, its presence may be ascertained, and the constricting portion of the crural ring may be sufficiently divided to admit of reduction, without wounding the irregular vessel, if certain precautions be adopted; and, secondly, when complications may necessitate or endanger its division, it shows that the vessel may be tied, and what the plan of procedure in such cases ought to be.

First, then, as to the risk and chance of avoiding injury in ordinary cases of femoral hernia.

I will not enter into anatomical details further than to say that there are three different positions in which we find the obturator artery placed, in relation to the femoral ring, when it arises by a common trunk with the epigastric—viz., 1st, Descend-

ing closely applied upon the external iliac vein, to reach the obturator foramen, and hence lying to the outside of, or behind and to the outside of, a femoral hernia, and therefore out of all risk of injury during the operation. 2*d*, Passing down from the epigastric towards the obturator foramen—further removed from the vein, so as to divide the femoral ring into two sections, in which case it might be either pushed aside, or stretched in front of a hernial protrusion, or, as in a case described by the late Mr. Allan Burns, have two small hernial protrusions, one on either side of it. 3*d*, The artery arising from the epigastric passes upwards, then curves round the upper, and descends along the inner margin of the femoral ring to gain the obturator foramen, so as to encircle a hernia passing out at the femoral opening, in all the directions available for incision. It is to this last irregularity I would at present direct attention. As regards the statistics of this form of irregularity, there is considerable discrepancy, some authorities, as Mr. Quain, stating it at nearly 1 in 10; Velpeau, 1 in 15; and Monro, 1 in 20 or 25. It is evident, however, that practically, no matter how rare or frequent such an irregularity may be, the surgeon can never predict in what case he may meet with it, and is therefore bound to act in every case with the same caution as if it were present.

This arterial irregularity, as coincident with a femoral hernia, must be, of course, still more rare, yet there are several such cases on record.

There is a preparation in the Barclay department of the Museum of the Edinburgh College of Surgeons, showing such a coincidence; and the late Mr. Liston had one in his museum.

In at least two cases the artery has been wounded during the operation for strangulated femoral hernia: once in a case operated on by Baron Dupuytren, where its division was only discovered after the patient's death from other causes. The other case occurred to Mr. Skey of St. Bartholomew's; in it the bleeding was profuse at the time, the lower end of the artery was tied, the upper could not be secured, but bleeding was arrested by other means, for the patient only died some days afterwards,

from the effects of a drastic purgative given by mistake. Lastly, in a case which occurred to the late Dr. Richard Mackenzie, it was found, on the patient's death some weeks after the operation, that the irregular obturator had encircled the neck of the sac, but had escaped division. (See woodcut at p. 1207.)

Now, these cases show that the artery has been accidentally cut, and also accidentally avoided ; but the case I have recorded goes a step farther, for it shows that the surgeon, by proceeding cautiously, and feeling with the pulp of his finger before dividing the constriction formed by the deeper or higher portion of the crural arch, may detect the presence of the irregular vessel, and then, by cautiously notching the constriction, to a very slight extent, at two points of its circumference, he will gain room sufficient to enable him, either with his nail or the point of a small flat director, to push the artery out of the way, while he divides the stricture more fully.

By following this plan, I was enabled to relieve the constriction, so far as to draw down and examine the intestines contained in the sac, and readily to reduce the portion of the ileum, so that, under ordinary circumstances, no further incision would have been necessary, and the vessel would have remained intact.

Of course, if the operator holds the opinion that the whole thickness of the crural arch, including Poupart's ligament, ought to be divided in every case, then the irregular vessel runs a much greater risk than if he limits his incision to the division of that portion of the arch formed by the convergence of the abdominal fasciæ, below Poupart's ligament, which immediately constricts the sac, and which is all that I have almost ever found it necessary to divide in cases of femoral hernia.

Secondly. The case, however, shows that certain complications, occurring in a femoral hernia where the irregular obturator artery was present, might render it necessary to divide the surrounding textures so freely, for the purpose of reducing the protrusion, that there would be very great risk of wounding the vessel ; or that, from the artery tightly surrounding the protrusion, it may absolutely require to be divided, as itself an obstacle to reduction :

And this leads us to the consideration of what these complications are, and how such difficulties may be best met and overcome.

Though I have mentioned the irregularity of the obturator artery as being an obvious and serious complication in the case, it was by no means that which gave rise to the greatest difficulty ;—indeed, from my remarks under the first head, it may be seen, that I hold that, except for the other conditions of the hernia, the irregular vessel would not have given rise to much difficulty, or been in much danger of being wounded.

The real difficulty which complicated the operation was, I think, the bulky and irregular form of the protruded cœcum ; its comparatively fixed position, by its peritoneal attachments, near the site of the femoral opening ; and its posterior cellular connections, not allowing it to slip back like a portion of the floating intestine ; and last, not least, the state of the bowel, from the previous attempts at the taxis, forbidding all further pressure or manipulation that could possibly be avoided.

The form and connections of the cœcum always render its reduction slow and gradual, even under more favourable circumstances, where the bowel can safely bear moderate compression, and where the constricting textures have been very freely divided,—as I found in a case of inguinal cœcal hernia, on which I operated some months ago, where there was no limitation to making the incision of the constriction very free indeed ; and I have also seen the same difficulty, though to a much less degree, in cases where the sigmoid flexure of the colon formed the contents of inguinal herniæ. In femoral hernia, however, where our incisions must, in general, be much more limited, and, especially, when we have ascertained the presence of an irregular artery round the upper part of the ring, the causes of difficulty I have alluded to become very embarrassing, and require us to adopt great caution in dividing the constricting textures. It was the eccentric pressure of the bulky distended gut which brought it into contact with structures which do not ordinarily form the seat of stricture, and in this way the irregular artery, dragged

and stretched to the utmost by the distended portion of the cœcum, had come to form a cord-like constriction upon it, requiring division before the bowel could be returned.

As to the plan to be adopted in such cases of femoral hernia, requiring such free incisions to relieve the bowel, I can only say that, after much consideration of this case, I would still proceed to divide the superimposed textures by the same method—viz., by dissecting cautiously through the lower division of the tendon of the external oblique, and the other textures, down to the peritoneum, in a line corresponding to the centre of the femoral ring, the cord being drawn aside. Thus all danger of wounding the artery accidentally is avoided, and if it be found itself constricting the swelling, it will not be found very difficult to bring it into view and put ligatures upon it.

This plan is that which Sir Astley Cooper recommended as safest and best in all cases of large femoral hernia; and although I cannot think, after some experience in femoral herniæ, that it is either necessary or advisable as a general plan, it will be found the safest in complicated cases requiring more than usually extensive incisions; it is, in fact, a cautious dissection down upon the upper part of the sac, or the parietal peritoneum immediately above and continuous with it, and if carefully conducted, is attended neither with difficulty nor danger.

IV.—GROUP OF CASES OF HERNIA.

(From Clinical Report for 1860-1.)

1. Mary Stark, æt. 43. A femoral hernia first came down ten days previous to admission. Taxis twice applied by her medical attendant; bowels had not been opened up to the date of her admission into hospital, when she was suffering from well-marked symptoms of strangulated femoral hernia. The operation was immediately performed, and the bowel was found perfectly black, with greyish patches, and had a distinctly gangrenous odour. The constriction being divided, the bowel was not returned into the abdominal cavity. An opiate was administered, and a poultice applied to the wound. Ordered calomel and opium pills every fourth hour. Bowels opened next day. Patient died on the third day after admission.

2. Janet Dalziel, æt. 71. Strangulated femoral hernia. Symptoms existed for five days. Sac opened. Bowel returned. Cured.

3. Catherine Reilley, æt. 32. Strangulated femoral hernia. Down thirty-six hours. Sac opened. Bowel returned. Cured.

4. Mrs. Notman. Had been troubled with an oblique inguinal hernia for six years, which, however, was always readily reduced, with the exception of a small part which never could be kept up. On the day previous to admission into hospital it had again come down, and she had experienced severe twisting pain in the umbilical region, together with nausea and vomiting, which, on the following day, became stercoraceous, when she was at once sent to hospital. On examination it was found that, in addition to the hernial protrusion of left side, there existed directly over the crural canal of the right side a hard, isolated, prominent, and well-defined swelling, about the size of a walnut, which patient stated had commenced a year ago, and gradually enlarged. The protrusion on the opposite side could be easily returned within the external ring; but doubts being entertained as to its complete reduction, it was cut down upon, and a constriction was found to exist at the upper part of the canal. The bowel was returned, and a distending injection given immediately after the operation, which brought away a large quantity of bilious-looking fæces. Hernial symptoms were now quite relieved; but the patient suffered from severe bronchitis, and for some years past she had been affected with cancer of the os uteri. The hernial wound healed rapidly; but the patient died three months afterwards from the cancer of the womb and bronchitis.

5. Janet Patterson, æt. 40. Strangulated femoral hernia. Down thirty-six hours. Sac opened. Bowel claret-coloured, but not gangrenous. Cured.

6. Catherine Duncan, æt. 34, wife of gardener, Loanhead. Femoral hernia. Admitted 30th September. Hernia frequently down during the fifteen months before admission. For a month before admission almost continuously down. About 7 o'clock on 30th September bowels were moved. At 8 o'clock felt pain in lower part of abdomen. At this time the tumour had increased to the size of a pigeon's egg. She became sick and vomited phlegm. Never felt twisting sensation at umbilicus. She, along with a female friend, persevered for nearly two hours in trying to reduce the swelling. It then became as large as a small hen's egg. At 1 o'clock, Mr. Spence tried the taxis. Ordered a distending injection, and cold to be applied to tumour. No fæces came with injection. At 6.30 P.M. Mr. Spence operated. The bowel very black, but no gangrenous odour. It was returned, and the wound closed. After the operation, everything proceeded favourably, except that some irritation caused by flatulence existed during the first few days.

CONGENITAL INGUINAL HERNIA.

7. Charles Mason, æt. 19, was admitted on the 4th October last, labouring under a strangulated congenital hernia. The hernia had come down suddenly that morning; and after its descent he had suffered from severe pain in the swelling, tenderness of abdomen, and vomiting. Previous to admission, antimonials had been given, and the taxis twice tried under chloroform. On admission, after a distending enema had been administered, and cold applied to the swelling, the patient was put under chloroform,

and the operation performed. About a foot of small intestine of a deep chocolate colour was found in the sac, and returned. A large opiate was ordered.

Post-mortem appearances.—About a foot of bowel quite black and suppurating on the serous surface. Submucous tissue highly congested.

FEMORAL HERNIA. EXTRA-PERITONEAL OPERATION.

8. Helen Steele, æt. 36. On admission, stated that she had been afflicted with a hernia for the last ten years, and that she always wore a truss, but neglected on Sunday morning to apply it. About 9 A.M. she suddenly felt a severe pain in the right groin, and found that she was not able to reduce the swelling as she usually could do. A surgeon was called in, whose efforts to reduce it by taxis, without the aid of chloroform, were unavailing. She came to the Infirmary about 7.30 P.M. Mr. Spence performed the extra-peritoneal operation, and the patient made a very rapid recovery.

Remarks on the Cases of Hernia.—The group of cases presented in this Report is of very considerable interest, for it furnishes, in small compass, examples of some of the most important conditions met with in strangulated hernia, and the plan of treatment adapted for each.

The first case, that of Mary Stark, is an example of the bad effects of delay, permitting the incarceration to proceed to complete strangulation and gangrene. The case, in fact, had been treated for constipation in the first instance, and active purgatives administered before the hernia was discovered. Then the taxis was tried ineffectually. I was then requested to see the patient, and urged her to have the operation performed; but both she and her friends refused, and another day was lost before she came into hospital. Her condition was then very hopeless; her pulse was weak and intermitting, and she had stercoraceous vomiting and constant hiccup; but as the operation was the only chance for life, I performed it. After the division of the stricture I drew down the gangrenous portion, but did not open it till after some hours, when lymph had become effused; so as to diminish the risk of extravasation of fæces into the abdomen. I then opened it freely, and there were fæculent evacuations both by the wound and by the anus. The operation afforded great relief to the general symptoms, the vomiting ceased, and the pulse became firmer for a time; but this reaction soon ceased, and she gradually sank. I believe, from the slow progress of the symptoms, that had this patient been operated on even a few days earlier, there can be little doubt the result would have been as favourable as in the case of Mrs. Dalziel; and I think medical men can hardly be too much impressed with the necessity for careful examination, in all cases of obstinate constipation, lest a hernia be overlooked. The reason I did not at once open the gangrenous part of the intestine arose from having observed that in cases where this has been done immediately, the patients often sink very rapidly, with great increase of abdominal pain; and I believe this is due to some of the thin fæculent matter oozing back through the divided constriction into the abdomen. Freely dividing the constriction, drawing down the gangrenous part, and applying warm-water dressing, or

a soft poultice, for a few hours before opening the gut, diminish this risk ; and I have for some time adopted this in my practice as a general rule.

The cases 2 and 5 were cases in both of which the strangulated intestine had suffered to the extent of threatened gangrene in the protruded knuckle. In the case of Mrs. Dalziel, an old woman above 70, the rupture had been down five days, but as the symptoms did not become urgent till thirty hours before admission, she had not applied for medical aid. In Patterson's case, the symptoms had proceeded rapidly, and become very urgent in less than thirty hours. In both, the small portion of intestine in the sac was tightly constricted, of a dark claret colour, and mottled with grey spots ; but the intestine above the constriction was healthy, and not distended or inflamed. In cases of this kind I adopt the practice I followed in these cases, viz., of dividing the stricture very freely, gently replacing the intestine within the margin of the ring, but leaving the dark part visible, and the wound open, and merely placing a fold of lint soaked in warm water over the wound, retained by a single turn of a bandage. Thus, if sphacelation or ulceration of the dark portion of the gut does occur, the fæces pass out at the wound, and this gradually diminishes, and ultimately the fæculent fistula closes completely ; whilst in other cases the gut regains its vitality when the stricture has been relieved, and the case, as in the instance of Mrs. Dalziel, goes on uninterruptedly to a cure by contraction and granulation. In most cases, if a fæculent fistula is to form, it begins to show itself between the sixth and eighth day ; but in Patterson, the wound, though carefully watched and dressed, in expectation of a fistula forming, seemed to heal well, though slowly, and after eight weeks she left the hospital wearing a truss. Some weeks afterwards a small abscess formed, and then small quantities of thin fæces occasionally passed ; but now the fistula is almost entirely healed. I have never seen that condition occur so long after the operation in any other case, and I think it is most likely that the pressure of the truss not carefully applied had caused irritation and abscess under the cicatrix, which may have perforated the adjacent bowel.

Mrs. Notman's case (4) is a very instructive one, as exhibiting the difficulties which often complicate our diagnosis in cases of hernia ; and as it was impossible in the abstract of the case to give a full idea of these, I think it well to draw attention to them. The abstract of her case states briefly the facts observed on admission, viz., that along with symptoms of strangulation, there existed in the left inguinal region a cyst-like swelling, globular, and not painful, easily pushed back within the lower part of the canal, but reappearing whenever the pressure was removed. She stated that this swelling was always present, but that sometimes a larger swelling came down ; all that could be felt high up in the canal was an undefined hardness near the deep ring. In the right inguino-femoral region there existed a swelling about the size of a walnut, hard, but elastic at the most prominent part, tender to the touch, and occupying exactly the position of a femoral hernia. Looking at these local conditions in conjunction with the symptoms, everything would have favoured the idea that the swelling in the femoral region was most likely to be the seat of strangulation. Fortunately, however, I knew something of her case ; for about a year previously she had consulted me about the swelling in the right groin, supposing it was a

rupture. The stony hardness of the tumour at that time, and the general cachectic look of the woman, left no doubt on my mind that it was a cancerous gland, probably connected with malignant disease of the uterus ; which opinion was confirmed by examination with the speculum, showing decided cancerous affection of the os uteri. Hence, when I now felt the elastic swelling, I at once concluded that the elasticity was due to the progress of softening, and not to any portion of gut protruded behind the swelling. But, on the other hand, there was little doubt in my mind that the round cyst-like swelling did not contain strangulated intestine, for there was no continuous neck to be felt : it was quite defined and globular. The hardness and tenderness at the position of the deep inguinal ring was what appeared to me the suspicious point. I accordingly explained to the students present that I would cut down upon and lay open the inguinal canal, and expose the deep ring fully, in hopes of finding a portion of strangulated intestine there, but that if nothing was found there, then I would (however unwilling) consider it my duty to cut down upon the cancerous mass in the femoral region, in case a small hernia might have descended and be strangulated behind it, as the urgent symptoms were unmistakably those of strangulation. On laying open the left inguinal canal, I found, as I suspected, a very small knuckle of intestine, tightly constricted by the neck of the sac, the constriction appearing to proceed upwards within the deep ring ; this was cautiously divided, and the gut gently examined and returned. I now found the globular cyst lying loose in the lower part of the canal, and on tracing the opened sac downwards, I found it had evidently at one time formed a part of it, as, though I could not press out the contents of the cyst, there was a minute opening of communication which admitted an Anel's probe. I laid the cyst freely open and evacuated its serous contents, and then dressed the patient in the usual manner.

The line of practice followed in this case seems to me the proper treatment under similar circumstances. I think it important always to bear in mind, that although we may from previous knowledge be sure that a tumour (such as that in the right groin in this case) occupying the position of hernia is really glandular or cystic, yet, if at any time symptoms of strangulation occur, we should recollect the possibility of hernial descent taking place behind it, and act accordingly.

The case of the lad Mason is valuable as illustrative of the dangers peculiar to the congenital form of inguinal hernia, and also as it serves to direct attention to some dangers connected with the treatment resorted to, to facilitate reduction by taxis.

The cases of Reilley, Duncan, and Steele (3, 6, and 8) were ordinary cases of strangulated femoral hernia, where the strangulation had not existed very long. In the first two the sac was opened, because from the one hernia having been down thirty-six hours, and the other having been subjected to violent attempts at reduction by the patient and her neighbours, I had doubts as to the state of the contents of the sac. Whilst in the last case, that of Mrs. Steele, the hernia being quite recent, no undue violence having been used, and the constriction evidently caused by the textures external to the sac, there was no reason for doing more than dividing these, emptying the sac of its contents, and then invaginating it.

DISEASES OF THE URINARY ORGANS.

CASE OF INTESTINAL OBSTRUCTION—GASTROTOMY.

Margaret Nicholson, æt. 66, single, stocking-worker. Admitted into Bed 1, Ward XI. (medical), Royal Infirmary, March 22d, 1871.

History of Present Illness.—About seven weeks ago patient got a mixture for her cough, which had the effect of causing constipation. Her bowels gradually became so torpid that they were never moved above once a-week, and then only by the use of laxatives. A fortnight previous to her admission aperients failed to relieve the bowels, and the patient began to get sick and vomit. Three days ago her abdomen began to swell, and the vomiting became constant. Vomittings were not fæcal. During this fortnight she has had constant desire to empty the bowel, but nothing came away but a slimy mucus.

The patient had previously suffered from prolapsus uteri, for which an operation was performed by Dr. Keiller. Before the swelling of abdomen commenced, patient says she had a bulging out of the abdomen about the size of her two fists, just below and to the left of the umbilicus.

CONDITION.—On admission, March 22d, patient has not an anxious expression nor a cachectic look.

Abdomen is swollen, especially below umbilicus, and in both inguinal and lumbar regions of both sides, slightly more in right than in left. Tenderness in right hypochondrium. No hard lump or tumour can be felt. The whole of the swelling is tympanitic, only the note is impaired in a space $1\frac{1}{2}$ inch square, just below and to the left of the umbilicus.

TREATMENT.—Enema of castor-oil, etc., was tried, but without effect.

March 23d.—Abdomen as above. Examination per rectum discovered a rounded firm mass projecting into the canal $2\frac{3}{4}$ inches from the anus. Canal not blocked up; finger can be passed beyond the tumour. Nothing felt higher up the rectum. Per vaginam, same tumour felt, but relations to uterus not determined upon. Uterus seemed displaced.

March 24th.—Abdomen more distended in cœcal region, forming a projection about size of cocoa-nut, which becomes diffused into general swelling. Still tympanitic note, especially clear in course of large intestine, except in left lumbar region, which is not so markedly distended. Friction can be felt and heard in upper part of right lumbar region. Great tenderness there.

Injection of water tried, but only 10 oz. could be thrown up. Repeated several times, but brought nothing away. Rectal bougie could only be passed for $4\frac{1}{4}$ inches. When entered $2\frac{3}{4}$ inches, it met with an obstacle, but this was passed by inclining its point backwards.

March 25th.—Abdomen more distended. Cœcal swelling continues. Course of transverse colon distinct. Descending colon not so marked, and there is an absence of swelling both anteriorly and posteriorly at the site of splenic flexure of colon. Sigmoid flexure swollen and tympanitic.

Professor Spence was called in. Examined the case, and confirmed previous observations. Tried to pass a tube and inject water, but results obtained similar to those of former attempts. Recommended injections to be again tried, which was done, but without effect.

March 26th.—Professor Spence, Professor Sanders, and Dr. Watson consulted over the case. Colotomy in the left lumbar region posteriorly was suggested, but rejected on the ground of the absence of swelling at the splenic flexure, this raising the suspicion of an obstruction being at this point, or in the small intestine. Gastrotomy was determined upon, and performed by Professor Spence, with the assistance of Dr. Watson.

OPERATION.—A cloth having been bound round the abdomen, with an opening in the central line, Mr. Spence made a longitudinal incision through the integuments in the line of the linea alba, beginning about an inch below the umbilicus, and continued downwards for about $4\frac{1}{2}$ inches. The textures were carefully divided down to the peritoneum, and, after the bleeding points had been secured, the peritoneum was opened along the line of the incision. On this being done there appeared a coil of convolutions of the small intestines, some of them distended and congested, others quite flaccid. Partly overlapping and pressing on this mass there appeared an ovarian cyst about the size of a small melon. The convolutions of intestine, on being relieved and drawn up from under the tumour, presented at several points the appearance as of recent adhesions, and one portion was dark, thickened, and granular on its peritoneal surface, similar to what we see in some cases of strangulated hernia. The flaccid convolutions were above this part. The ovarian cyst was punctured with a trocar and india-rubber tube, and the fluid drawn off, the pedicle transfixed and tied with double ligatures, and the tumour removed. On its removal, a cystic and partly solid tumour of the left ovary was felt in the pelvis, the solid portion in close relation to the upper part of the rectum, and having connections by old adhesions. It was now thought advisable to extend the incision upwards to ascertain fully the state of the colon, and, on this being done, it was seen to be contracted, but not constricted beyond its splenic curve. The ovarian tumour on the left side was now gently drawn upwards, and its adhesions separated as carefully as possible, and the pedicle secured and divided. On removing the tumour, it was now found that the lower part of the colon, at its junction with the rectum, had been closely connected to the left ovarian tumour, and that there was a small aperture in its coats at the point where the adhesion had existed. The rectum was firmly tied below this aperture, and the gut divided and its open end brought to the surface. At first little or no feculent matter came away, until, by uncoiling the small intestine and pressing the cœcum and transverse colon, the feculent contents of the intestines began to pass along the gut. The cavity of the pelvis was then carefully washed out, the viscera replaced, and the wound closed, with the exception of the lower part, at which the divided colon was brought and its edges carefully secured to the integuments by continuous suture. A piece of oiled lint was placed around the opening, and the patient placed in a position to favour the escape of the feculent matter. The woman, who was in a very exhausted state before the operation, rallied somewhat, but ultimately sank about midnight.

Remarks.—This case exemplifies the difficulties of diagnosis, and the complications which occur in cases of internal intestinal obstruction, and which render gastrotomy such a doubtful procedure. In this instance, whilst there were obvious causes of obstruction in the rectum, the principal obstruction was situated in the small intestines, and was caused by the coil of gut which had descended into the pelvis being so compressed between the two ovarian tumours, that irritation had been excited, and recent adhesions had occurred.

CASE OF RUPTURE OF THE URINARY BLADDER.

(Read before the Edinburgh Medico-Chirurgical Society, 1860.)

THE following case of ruptured bladder seemed to me of sufficient interest for publication, as a contribution towards the illustration of a class of injuries in which, as in the present instance, *post-mortem* examination not unfrequently reveals conditions which could scarcely have been predicted from the symptoms during life :—

On the night of the 10th December last, J. J., a healthy man, aged 32, had been supping with some friends, and, feeling his bladder much distended, left for the purpose of making water. On going hurriedly down stairs, he slipped his foot and fell backwards with considerable force, the back of his head striking against one of the steps. He was found lying insensible, and was carried upstairs to the house he had just left, and laid on a bed. In the course of an hour, the effects of the concussion diminished ; he became more conscious, was restless, and somewhat incoherent, constantly crying out he wanted to make water, and vainly attempting to do so. As this state continued, he was put into a cab and driven home to his own house ; and next morning (the 11th December 1859), his wife sent for Dr. Menzies, who visited him at 10 A.M. He was then quite sensible, but still unable to empty his bladder. Dr. Menzies passed a full-sized catheter easily, and drew off nearly a chamber-potful of bloody urine, with great relief. He, however, complained of severe pain over the abdomen, increased on pressure ; his pulse was hard and wiry ; and there was tympanitic distension. Dr. Menzies bled him, to a slight extent, with considerable relief to the pain ; and as it appeared his bowels had been constipated for some days previously, an enema was ordered to be given. In the evening, Dr. Menzies again drew off a large quantity of urine, much less bloody ; his bowels, however, had not acted, the tympanitis was increased, and he had occasional vomiting.

I saw him on the morning of the 12th December, at Dr. Menzies's request. At that time the anxious expression of his face, shrunk features, and sharp, irregular pulse, together with restlessness, frequent vomiting of greenish fluid, and hiccup, taken in connection with the history of his case, left no doubt on my mind that rupture of the bladder had taken place. I introduced a No. 12 catheter easily; but as Dr. Menzies had shortly before drawn off his urine, there was very little in the bladder, and it was slightly bloody. As he suffered greatly from the distension of the bowels, another enema and a purgative by the mouth had been administered; and I recommended that, after the bowels had acted, the use of opiates should be commenced, and directed a sinapism to be applied over the epigastrium to relieve the vomiting. Next day I found him easier; the bowels had acted freely, with complete relief to the pain and tympanitis, so that he could bear pressure over any part of the belly. There was still small, quick pulse, the anxiety of countenance remained, and vomiting and hiccup continued, although much less frequent than before. The urine which had been drawn off was in large quantity, perfectly clear, and free from the slightest sediment or muddiness. The opiates were ordered to be continued; and he was directed to have a little wine, and some essence of beef for diet. On the 14th, I found he had passed a very restless night, and he seemed much weaker; the pain, vomiting, and hiccup had diminished, but the expression of the face was very anxious. The urine which had been drawn off was copious in quantity, and quite clear. The treatment was continued, with the exception of a little brandy in place of wine, as the latter turned acid on his stomach. During the 15th he became rapidly worse, the vomiting and hiccup recurred with increased intensity, and he gradually sank, and died at half-past seven P.M. of that day.

Post-mortem Examination.—On opening the abdomen, the large intestine was found contracted, the small intestines and omentum were rather more congested than naturally; but the peritoneal surfaces presented the usual smooth, glistening appearance. There was no marked vascularity either of the parietal or visceral peritoneum; its surfaces seemed more bedewed with serous secretion than usual, although this did not amount to serous effusion. There were no adhesions, and only a very few minute flakes of lymph towards the epigastric region. On looking at the hypogastric region, the bladder was seen to be contracted (the urine having been drawn off shortly before the patient's death); and, on observing the viscus as it lay *in situ*, it presented the appearance of a rent at the posterior aspect of its superior fundus, apparently not larger than half an inch in length, its peritoneal investment, as well as its proper coats, having given way; the margins of the rent were in close contact, so that it looked like a mere fissure. A little turbid urinous fluid, and some folds of small intestine, occupied the inferior *cul-de-sac* of the peritoneum; but no fluctuation or distension could be detected on examination by the finger in the rectum. On removing the bladder and examining it carefully, I found the rent of its coats to be much more extensive than it seemed to be when seen in position in the body, as it was now found to measure about two inches in length, as seen in the preparation.

Remarks.—The features of this case which seem to me most suggestive of remark are: 1st, The small amount, or almost entire absence of those morbid appearances which generally result from an inflammation of the peritoneum characterised by such urgent symptoms, and such an extremely irritant exciting cause. When we recollect the amount of organic changes—such as extreme and general vascularity of the serous surface, the effusion of turbid serum and masses of lymph, and the matting together of the viscera—which usually follow the escape of even a small quantity of the contents of the intestines in cases of minute perforation; or in cases where a comparatively small quantity of urine is extravasated into the sub-peritoneal cellular tissue; it seems to me that the absence of such appearances in this, and some other similar cases recorded, can only be accounted for on the supposition that the extremely destructive character of the extravasated urine in large quantity, and in immediate contact with the peritoneal surface, may so depress the vital powers as to prevent the formation of the ordinary inflammatory products; a supposition, however, somewhat difficult to reconcile with the acute nature of the symptoms during life, and the period intervening between the receipt of the injury and its fatal termination.

The next remarkable feature of this case, and that which is most difficult of satisfactory explanation, is, the occurrence of retention of urine requiring to be relieved by the use of the catheter whilst there existed a rent in the bladder, through which we might have expected the urine to have escaped freely into the abdominal cavity. I know that it has been suggested that in such cases the urine does escape from the bladder, and that it is drawn off from the peritoneal cavity by the catheter passing through the wound of the bladder. The reasons assigned for this opinion are, *first*, the large quantity of urine drawn off in some of the cases, being in amount beyond the capacity of the bladder; and, *secondly*, the apparently physical impossibility of any considerable quantity of urine being retained in the bladder when such a wound exists in its coats. In regard to the former of these reasons, I do not consider it of much weight; because, in common with every surgeon who has had much experience in urinary cases, I know that, not unfrequently, cases of retention are met with where the quantity of urine drawn off is so enormous as to show it to be very difficult to calculate the capacity of the bladder, under certain circumstances. As to the second reason alluded to, whilst I grant the great difficulty of affording a satisfactory explanation of the retention of urine co-existing with such a wound of the bladder, yet the opposite hypothesis presents physical conditions equally difficult of explanation; and it will not do to reject all the phenomena observed during the progress of a case, merely because we have great difficulty in explaining the co-existence of certain apparently opposed physical conditions.

In the present case, the symptoms, both objective and subjective, noted during life, appear to me to amount to a demonstration that the urine evacuated by the catheter was contained in the bladder, and not diffused through the peritoneal cavity. A tumour corresponding to the distended bladder could be felt above the pubis, and disappeared when the urine was drawn off. The quantity on each occasion was not beyond the average amount in retention, and after the first thirty-six hours it was clear and

natural in appearance, and it flowed off through the catheter in a full even stream. Then, as regards the subjective symptoms, the sense of distension felt by the patient was unequivocal ; not the mere sensation arising from irritation, which frequently does occur in cases where the wounded bladder contains little or no water, but a sensation arising and increasing as the urine accumulated, and relieved when it was evacuated by the catheter. I consider this symptom as of importance ; for we know that when the urethra gives way, and extravasation occurs in a case of retention from stricture, the patient feels immediate relief from the sense of distension, and often thinks he is passing water naturally ; and we would expect the same to be the case if the fluid had escaped from the bladder into the abdomen.

On the other supposition, that the urine had been diffused into the peritoneal cavity, how can we reconcile this with the symptoms observed ? In cases where the urine has become diffused into the cavity of the abdomen—as in two cases mentioned by Dr. Innes, C.B., when this case was read to the Society—only a very small quantity of urine can be drawn off by the catheter. Nor, supposing the catheter to pass through the wound of the bladder, and reach the fluid, would it be likely to flow off in a continuous even stream, diffused as it must necessarily be amongst the viscera ; and as a considerable quantity must gravitate towards the pelvic *cul de sac* of the peritoneum, that could not have been drawn off, and would have been found there on the *post-mortem* examination.

I believe the best explanation of the case is, that the rupture being longitudinal, the contraction of the fibres of the muscular coat of the bladder, from their arrangement, would render it a mere fissure during life ; and the projection of the looser mucous lining might have a valvular action, preventing the urine flowing out by the wound, except very slowly and in small quantities, and only after a considerable distension had occurred.

In conclusion, I would advert to the bearings which this case has on the treatment of such injuries. Whilst, for my own part, I expect but little benefit from any treatment, inasmuch as I consider that the urine extravasated at first into the abdomen is in itself sufficient to induce the fatal effects, still, the length of time and the temporary amelioration of symptoms which occurred in this, and which have been noticed in similar cases, afford some glimmerings of hope as to more favourable results, could we but procure such a continuous drain of the urine from the bladder as to prevent it accumulating, and so obviate any further escape into the abdomen, and permit the wound in the bladder to heal. To introduce and secure an ordinary catheter in the bladder would be dangerous, as its point would be apt to pass through the ruptured part ; but I think a very short pointed catheter, similar to what is used in cases of vesico-vaginal fistula, and with the part corresponding to the anterior portion of the urethra, bent so as to droop, might answer the purpose ; or the operation of puncturing the bladder from the rectum, and leaving the canula or gum elastic tube for some days, would afford a still surer and more efficient drain. The objection to the latter operation, however, would be, that there is generally no absolute certainty as to the nature of the injury ; and we would naturally hesitate to perform an operation which might possibly be unnecessary.

The state of parts in this case showed me that the operation of puncturing the inferior *cul-de-sac* of the peritoneum, to evacuate urine supposed to be lodged in the peritoneal cavity, must always be uncertain, and often dangerous ; whilst, as the fluid is diffused, it would not be fully drawn off, and can only be possible in those very rare cases where the urine has accumulated, and is limited by adhesions—a condition, of the existence of which I am very sceptical.

CASE OF RETENTION OF URINE IN A POST-VESICAL CYST,
REQUIRING TO BE PUNCTURED FROM THE RECTUM.

(From Clinical Report, 1863-4.)

J. W., æt. 29. Had experienced some difficulty in micturition for some months previous to admission, but never amounting to complete retention until two days previously. Complete inability to micturate came on somewhat rapidly after his having been exposed to cold and wet. He was seen by a medical gentleman, who passed a catheter and emptied the bladder ; but on the following day he failed to get anything but blood through the instrument. When brought to the Infirmary the patient was in great agony from the accumulation of urine. Mr. Spence had some difficulty in passing a catheter, owing to the previous formation of a false passage ; but when he succeeded in passing a No. 8 catheter, and drawing off the urine from the bladder, he found that there still remained a considerable swelling in the hypogastric region. On examining per rectum he detected a fluctuating swelling behind the prostate, which he at once pronounced to be cystic, and proposed to puncture it when the urine had re-accumulated in the bladder. There was no stricture of the urethra, but the tilting forwards of the prostate by the swelling behind had evidently given rise to the difficulty in passing an instrument. In the evening Mr. Spence punctured the cyst per rectum, and drew off twelve ounces of a pale, slightly albuminous fluid. Thereafter the patient passed urine without assistance, and the swelling and dulness on percussion disappeared from the hypogastrium. Inflammation of the post-vesical cyst supervened ; the latter was at the end of a fortnight again punctured, and a large quantity of purulent fluid evacuated ; the canula was left in to act as a drainage tube, but happening to become displaced had to be withdrawn, and, of course, could not again be passed until the fluid re-accumulated. Sedatives and diluents were frequently administered. Hot hip-baths were repeatedly used, and poultices or hot fomentations continually applied to the hypogastrium ; but the patient became hectic and ultimately died.

At the autopsy there were found—a suppurating cavity behind the bladder, with well-defined, rather thin walls, containing a few ounces of purulent fluid ; great enlargement of the prostate, with a suppurating cavity communicating with the floor of the urethra ; inflammation of the bladder, with several patches of diphtheritic-looking exudation on its mucous surface ; catarrhal nephritis.

The above instance of this rare affection is the second* which Mr. Spence has met with in his practice. The fatal result must, unfortunately, be attributed to the false passage in the prostate and distension of the bladder giving rise to general inflammation of the urinary organs, and apparently to suppuration of the cyst : for it is probable that, had the urinary organs been in a quiescent state, simple puncture of the cyst would not have induced suppuration ; and, had it done so, the chances of a favourable result would, notwithstanding, have been infinitely greater than they otherwise were.

CASE OF HYDATID CYST BETWEEN THE BLADDER AND RECTUM.

(From Clinical Report, 1862-3.)

J. F., æt. 55, a native of Yorkshire, was admitted August 23, suffering from retention of urine, to fits of which he had been liable for the previous eight months. On this occasion, several unsuccessful attempts had been made to relieve him before sending him to Mr. Spence, who, on examination per rectum, detected a large fluctuating cyst in the recto-vesical space, and as the curvature of the urethra was thus increased, he selected a prostatic catheter, and introduced it without much difficulty. A large quantity of water was drawn off, but the cyst, which at first was thought to be a dilated portion of the bladder, underwent no diminution in size. This proved its independent origin, and as the man was in apparently good health, and had never suffered from inflammatory symptoms in the pelvis, and as there was an indistinct feeling of a tumour deep in the right hypochondrium, it was thought probable that this was an instance of a hydatid cyst in a very uncommon situation. The patient was kept under observation, and the water regularly drawn off. At the end of a fortnight, the cyst was tapped by a curved trocar introduced per rectum. A considerable quantity of clear fluid escaped, in which, both on ordinary visual, and on microscopic examination, numerous hydatids were detected. The discharge from the rectum continued for a few days and then ceased. The cyst refilled, but while the patient was making efforts at stool, it burst ; the fluid was again submitted to the microscope, and was found to contain the shreds of broken down acephalocysts. For a short time discharge continued to be passed of a purulent character, but this gradually diminished, and ultimately disappeared, leaving only a degree of hardness in the position formerly occupied by the cyst. At the date of dismissal (10th October), the deep-seated swelling in the hypochondrium had become much more perceptible to the touch. It could then be defined as a small tumour, about the size of an orange. On his returning about a month afterwards, it had attained the size of a melon, and on his again presenting himself, at the end of two months, it filled nearly the whole of one-half of the abdomen.†

* This is a mistake. The other case was that of hydatid cyst, which follows.

† I learned some years ago that this ultimately burst into the bowel, and the patient, when I heard of him last, was quite well.

The case of hydatids is interesting from the rarity of this affection in Scotland ; from the symptoms leading to a correct diagnosis of its nature ; and from the effective treatment without any tendency of the inflammation of the cyst to spread to adjoining organs.

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